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Working to Ease the War Burdens

IT IS highly necessary that adequate steps be taken to place before the public service commissions all of the facts which testify eloquently to the war burdens borne by the public utilities. The work of the National Committee on Public Utility Conditions, representing the associations of utilities in the electric, electric railway and gas industries, is of first importance. Differences as to the general characteristics of these three classes of properties can safely be ignored for the time being; the important consideration just now is that they are all affected by higher costs of labor and materials. Rising costs and rigid rates threaten bankruptcy. If costs do not go down, rates must go up, or the net result will be insolvency for many properties. The problem is as plain as the trouble of the corner grocer who sees his margin grow slender. He promptly puts prices up. To do the same thing the public utility has to have sympathetic co-operation from the public service commission which has jurisdiction over it. Fortunately the truth is understood by a number of the commissions. Their members appreciate that the crisis is due to the war and that it calls for heroic treatment.

Electric Drive for Woodworking Machinery

EVERY industry brings its own problems to the electrical engineer. There is no universal solvent for all the difficulties which he has to meet, for not only every class of work but every individual example requires consideration by itself if the best economic results are to be obtained. General averages are of help in forming judgments, but they do not give the key to the individual problem. Some specific conditions which have to be met in the woodworking industry are pointed out in W. A. Black's discussion in the current issue of the motor drive found desirable in a particular plant. Woodworking machinery requires an exceptional amount of space on account of the bulky nature of both the raw material and the product. If laid out with the compactness sometimes very indispensable, it would be both inconvenient and costly to operate. Hence, if driven by the ordinary steam-power plant with its long lines of shafting and many pulleys, it wastes a great deal of energy on account of the scattered nature of the power distribution. It may turn out in fact that a long line shaft must be continuously operated for a few small machines. Many types of woodworking apparatus must be employed for the specific uses required by the plant schedule, and these require extra room and more shafting, so that on the whole electric drive in woodworking shops has unusual opportunities for economy.

With individual motors the losses are practically directly proportional to the output of the machines doing useful work, and the uncertain factor now becomes the effect of the operating schedule on overhead cost. It was found, for instance, in the plant described by Mr. Black, that in certain places individual motors would prove to be uneconomical. For example, a battery of nailing machines used for box making gave its best economy through group drive. Each of the five machines constituting the group takes part in a continuous process, but the load of each is from its nature intermittent, and the group as a whole shows a conspicuous diversity factor, so that while each machine would have required when operated by itself a 2-hp. motor, one 5-hp. machine handles the whole group easily at good load and efficiency. To keep down losses the ball-bearing type of motor is used throughout, and it was found advisable to belt machines freely up through the floor from motors suspended from the ceiling below, thus shortening the belts and getting them out of the way. The ball bearings, too, proved to have an advantage in the abolition of the oil and grease which would otherwise cause a sticky coating of the inevitable dust found in woodworking plants. Motors can therefore be kept clean simply by blowing them out by compressed air. In one special case vertical-shaft motors were used to avoid the necessity of quarter-turned belts. Throughout the plant particular care seems to have been taken in adapting the type of motor, as well as its size, to meet the special requirements of the case. The result has been noticeable in the modest cost of operation and maintenance shown by three years of practical use.

A Big Canadian Steam Auxiliary

OUR readers will be struck by the ultimate development intended for the new steam plant of the Dominion Power & Transmission Company at Hamilton, Ontario. The company's main source of energy is a hydroelectric plant on the Welland Canal, about 35 miles (56 km.) from Hamilton, and this power is distributed over a wide area, being connected by three separate 45,000-volt lines to the main switching station just outside of Hamilton. The new plant is on the Lake Ontario waterfront near the load center of the entire system and is designed for an ultimate capacity of 75,000 kva. One-third of this is now installed in two

units. The equipment as designed not only furnishes auxiliary power but can be operated at high efficiency for additional output when it may become necessary. The layout of the plant is well shown in the elevation given. Provision is made for running the coal cars into a separate building, where they are unloaded into a receiving hopper; thence the coal is fed to a crusher and carried into the storage bins above the boilers by a conveyor. Thence again it is dropped to the underfeed stokers which serve the big water-tube boiler units. Both cooling and make-up water are obtained from the lake, the latter being subjected to a treating system before use.

The general layout of the plant is of the ordinary standard type, but each turbo-generator is normally supplied by a short pipe run from its own set of boilers, the piping being arranged so that one set of spare boilers will suffice for the entire plant. Each generator has its own motor-driven exciter, and a steam-driven exciter is held in reserve to be switched on to any machine in case of need. The generators are for 6600 volts, to be stepped up to 42,000 volts through transformers interconnected on the high-voltage side. The transformer arrangement is such that two sets of transformers will be connected to each pair of machines to localize trouble that may occur in either of them. Even power which is transmitted at 6600 volts is not taken directly from the generators but from the high-tension buses. As is commonly the case, the switching and transforming apparatus is in an annex to the main generator room. This the switchboard operator can overlook, he being stationed on the third floor of the switch house. The whole switching equipment is of the remote-control type, and in addition an ingenious set of signals between the boiler room, engine room and control room is organized with a combination of illuminated signs and Klaxon horns, thus appealing violently to two senses instead of trusting to one. The two transmission lines to the main switching line of the whole system pass from the roof of the transformer house and connect to the lightning arresters installed just outside. The station seems a singularly good example of recent practice in efficient design for operation on a large scale.

Ventilating Cable Ducts

THE rapid increase of industrial load in all our large cities puts heavy burdens on the underground distribution. There is a constant tendency to strain the capacity of the cables and increasing danger of breaking them down thereby, since there is a limit to the temperature which the insulation will stand without deterioration. The paper by William Keating and C. H. Mueller, abstracted in another column, gives a most instructive report of the results of overload and the possibility of increasing cable capacity by forced ventilation of the ducts. The particular duct line involved was one in Pittsburgh, less than a mile in length and called upon for heavy peak loads superimposed on a heavy regular load. In this particular line of ten ducts, eight of which were in use, there were no less than thirty-eight failures during the summer of 1916, in spite of the fact that the manhole covers were left off day and night. This showed plainly that the cable heating was far above the permissible limit, which for the internal temperature on 11,000-volt cables is somewhere about 150 deg. Fahr. (65.6 deg. C.), the internal temperature being normally something over 50 deg. above that measured in the duct. After considerable discussion of ways and means it was determined to ventilate the duct artificially. This was ultimately done by installing eleven pressure blowers in alternate manholes, the intermediate holes being left open to allow the hot air to escape. The effect of these in working through the summer was to bring down the duct temperature just below 100 deg. Fahr., even then very near to the danger limit. In the cool weather of October the blowers were shut down and the manholes closed, and inside of a week the average temperature had gone up more than 20 deg., which caused a rapid resumption of forced ventilation. The temperature in the ducts was found by drawing in indicating coils of which the resistance showed the temperature, and these have proved of considerable service in investigating the conditions in various ducts so as to determine the available extra capacity if any. Some recording instruments were tried, but they proved to be too delicate for the rather hard service. This artificial ventilation of duct lines is, of course, a last resort, but one which may be not infrequently necessary at the present time when loads are high and cables higher. The experiments described by Messrs. Keating and Mueller are certainly of very considerable value in showing for the first time on a really practical scale what can be done if necessary to keep down dangerous temperatures in high-tension cables.

Radiation Losses in Pipes and Fittings

WITH all the effort that is now being made at economizing fuel to keep down operative costs of central stations the subject of radiation losses rises to considerable importance. There is, it is true, little uncovered high-pressure steam pipe now in use in central stations, but the covering on valves, flanges, feed pipes and other fittings is seldom complete or efficient. It is not always convenient to provide them with proper heat insulation, but it can be done without any particular difficulty while still leaving them accessible in case of necessity. The economic importance of the situation lies in the fact that an unprotected bit of pipe or valve gets rid of a large amount of valuable heat which ought to be conserved. At the present time fuel is so considerable a portion of the total expenses in a properly operated central station that savings here are of large importance. Those which can be effected by stopping losses after the steam is generated are of particular importance because they practically are equivalent to improving the boiler efficiency. If this chances to be low, the actual loss from unprotected pipe is particularly conspicuous.

There have been a good many investigations into the properties of insulating materials, but these have not been properly correlated with the possible savings in building up an efficient standard practice in steam-pipe covering. A very wide variety of materials have been used for this purpose. So far as yet discovered entrained air is the best of these. Free air forms a particular poor insulation on account of the heavy

losses by convection, but when it can be confined in the interstices of a material in itself a poor conductor of heat the combination is extremely efficient as an insulation. The intelligent development of heat-insulating material has therefore largely been guided by its capacity to hold air by reason of its porous structure. For practical use in steam plants the selection of material on account of this property is very much limited, for it must be heat-resisting over long periods of time, not changing its structure or losing its fundamental valuable quality by reason of the temperature to which it is exposed. This bars out many organic substances which in themselves possess most remarkable heat-insulating properties.

Losses due to imperfect insulation are startling to those who have not made any study of the subject. A square foot of bare pipe at the ordinary temperature of steam pipes wastes six or seven tons of coal a year, if in continuous operation. At present prices of coal this is a serious matter not likely to be passed over by operators of central stations. The plain moral is to use as short steam piping as is practicable and to insulate it with painstaking thoroughness even at exceptionally high cost of material, for the loss in fuel is a continuing one not unlikely gradually to increase, particularly if poor insulation is used, while to offset it there is only the fixed charge on the cost of proper insulation. It therefore would be well to avoid all unnecessary leaks and complication in a steam-piping system and to insulate it in all its parts with scrupulous care.

The Characteristics of Dielectrics

DIELECTRIC materials are of great practical importance to the electrical engineer because he has to depend upon them in the construction of his machines and of his conducting lines. Considering their importance, it is remarkable how little quantitative and systematic knowledge exists at present concerning the electrical properties of dielectrics. One reason for this deficiency lies in the complexity of the subject. In a dielectric of the simplest kind, assumed to be homogeneous and single, we have to deal with electrostatic stresses which must necessarily be very variable in space, except under ideally simple geometrical conditions. We have the conductivity of the material to deal with, also its inductivity, its dielectric constant and its dielectric strength. All of these properties, which are merely salient selections, are subject to possible variation with impressed voltage, frequency, temperature, time and previous history. When we come to consider compound dielectrics, formed of several substances in layers or juxtaposed masses, the problem of electric behavior is likely to become very complicated. It is evident, therefore, that we must be content to study one phase of the subject at a time, in order to build up an engineering theory of dielectrics.

In C. A. Butman's article this week reference is made to the properties of two dielectrics well known to makers of electrical machinery; namely, fullerboard and paraffine oil. Some interesting experimental facts are recorded concerning these substances.

In regard to the fullerboard or presspan slabs, the measurements indicate that, after being subjected to the treatment described, the conductivity of the material, as determined by the ratio of the dissipated watts to the square of the impressed voltage, remained roughly constant up to the gradient of 31.5 kv. per centimeter, which is indicated to be about one-ninth of the instantaneous rupturing gradient. In fact, the conductivity decreased somewhat as the gradient increased from 0 kv. to 31.5 kv. per centimeter. This result is rather remarkable. It is generally assumed that the conductivity of a dielectric is either constant or increases somewhat with the impressed gradient.

The second remarkable fact about these slabs is that their power-factor or phase-angle defect, measured in radians, diminished materially at a given temperature as the impressed potential gradient increased. Thus, at 91 deg. C. the indications of Fig. 2 are that the power factor was 0.095 at 3.15 kv. per centimeter and fell to 0.052 at 31.5 kv. per centimeter, the current strength through the slab increasing directly with this gradient. But since the conductivity of the slab is shown to have remained constant over this range, at least as a first approximation, it would seem that the inductivity, or specific inductive capacity, of the material increased very noticeably with the impressed gradient. If so, this is a noteworthy result, because it is generally supposed that the inductivity of solid or of liquid dielectrics at constant temperature is virtually independent of the impressed potential gradient.

As regards oil, the results indicate that the inductivity was, at least to a first approximation, independent of the impressed gradient up to 16.76 kv. per centimeter, but that it increased markedly with temperature, at first in straight-line fashion and then, beyond 50 deg. C., faster. It is also pointed out that the minimum dielectric strength of this oil occurred near the temperature of —12 deg. C.

These quantitative experimental results are valuable, not merely because they are rare, but also because they are expressed in simple metric units that all electrical engineers can understand. When dielectric properties are measured they are all too commonly concealed when expressed in terms of uncouth and antiquated units that not even English-speaking people can clearly understand.

The Coming Issues

SCARCITY of power is a serious factor in the present industrial activity. It affects not only the central-station industry but also the output of supplies for the government by industries which depend on the great generating systems for energy. This situation will be considered in early issues. Among other subjects which will be treated are the standardization of overhead construction with a view to reducing costs; shop repairs to distribution transformers in the interests of economy of time and money, and the performance of polyphase induction motors. In the latter article it will be shown that the choice of motor depends on considerations of load, starting and running current, frequency of starting and efficiency of operation.

The Characteristics of Dielectrics

Results of Investigations to Determine the Dielectric Constants, Strengths, Loss Angles and Energy Loss of Micarta, Fullerboard, Paraffine Oil and Other Substances—Effects of Potential Gradient and Temperature Found Very Important

BY CHESTER ARTHUR BUTMAN

FURTHER development of electrical apparatus is dependent chiefly on the provision of insulation which will withstand higher stresses and temperatures, the reduction of internal heating or the improvement of heat dissipation and the incorporation of electrical or mechanical features which will prevent damage from current surges. Since dielectrics are often the source of considerable heat when subjected to high potential gradients and since their characteristics are considerably affected by numerous factors, including temperature and electrical stress, it is necessary to have a very complete knowledge of the nature of dielectrics if they are to be applied properly. In what follows the writer will outline some of the properties he observed in an analysis of this kind, using a high-potential low-frequency series inductance bridge.[1] Among the properties investigated were the dielectric constant, dielectric strength, dielectric loss angle, dielectric energy loss, conduction currents, and how these properties change with the potential gradient and temperature. Fullerboard and paraffine oil, used separately and combined, were the dielectric materials studied.

FULLERBOARD IN OIL

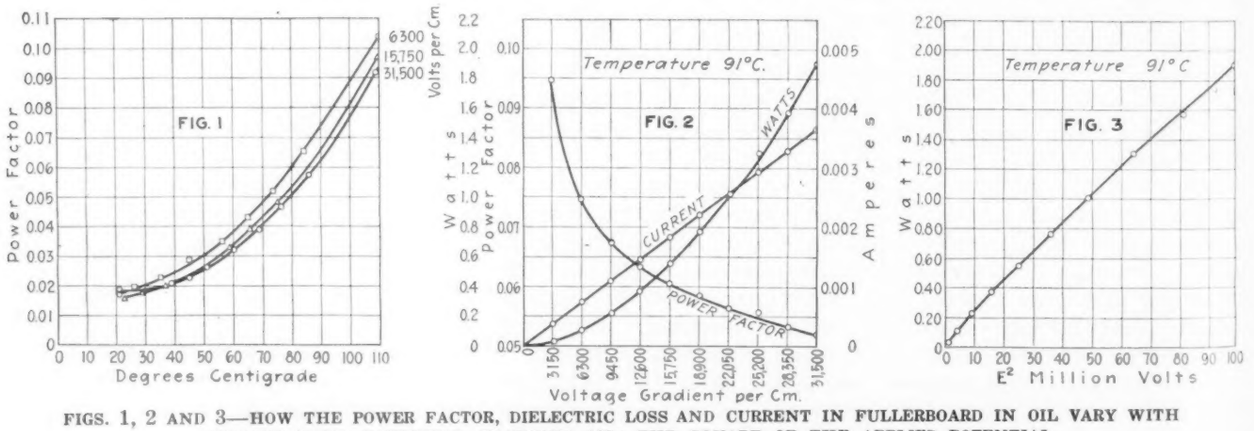
The fullerboard (presspan) which was tested was 0.32 cm. thick, uniform in quality and free from moisture. Before testing the samples were dried for three days in a vacuum oven and placed hot in the oil tanks, where they were allowed to soak until saturated.

Dielectric Strength.—The dielectric strength was found to depend upon the time of application of the potential and the temperature. The principal effect of raising the temperature is to retard formation of gas bubbles around the testing terminals. In most cases the point of breakdown was just outside, and in only a few instances was it between the electrodes. This may have been due to the combination of three dielectrics at the terminals increasing the dielectric stress. The time of breakdown appeared to depend on the formation of a certain number of bubbles at the electrodes. The writer is inclined to believe, however, that it is the time element rather than the formation of bubbles that determines the time of breakdown. The instantaneous breakdown potential was found to be 90,000 volts, which corresponds to a potential gradient of 283,500 volts per centimeter. The tests also showed that the samples would stand 30,000 volts (94,500 volts per centimeter) without breakdown at any temperature for an indefinite period.

Effect of Temperature on the Dielectric Loss Angle.—The relation between the power factor ($\sin \Theta_x$) and the temperature with varying potential gradients (Fig. 1) can only be considered approximate because the temperature of the material under test lagged behind that of the oil in which the thermometers were placed and because an approximate formula was used to calculate the results. Nevertheless, the results are important because they show that the highest potential gives the lowest power factor. The results were verified by testing a sample at a constant high temperature.

Effect of Potential on the Dielectric Loss Angle.—Micarta and fullerboard were tested under identical conditions at a constant temperature of 91 deg. C., but no dielectric hystersis was observed. The experiment showed further that the power factor[2] of micarta increases with the voltage whereas that of fullerboard decreases (Fig. 2). It is thought by the author that this phenomenon may be due to the fact that the electrostatic field increases the polarization faster than it increases the ionization. Consequently the substance becomes a better dielectric when under electrostatic stress. From the curve it may be seen that the total current is directly proportional to the voltage.

Relation of Energy Loss to Square of Potential.—The



FIGS. 1, 2 AND 3—HOW THE POWER FACTOR, DIELECTRIC LOSS AND CURRENT IN FULLERBOARD IN OIL VARY WITH TEMPERATURE, POTENTIAL GRADIENT AND THE SQUARE OF THE APPLIED POTENTIAL

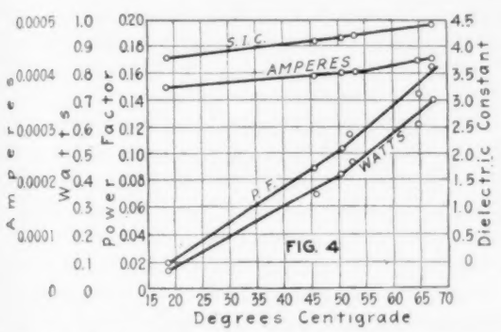
[1]Described in ELECTRICAL WORLD for March 9, 1918.

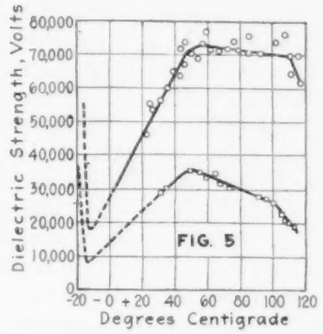
[2]The fact that power factor of fullerboard decreases with an increase in potential gradient is confirmed by J. P. Minton (*Proceedings A. I. E. E.*, p. 1148, June, 1915).

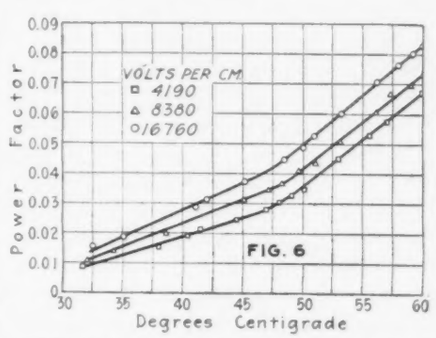
energy loss is not strictly proportional to the square of the effective potential, as may be observed from Fig. 3. In fact, it increases considerably slower.

HETEROGENEOUS DIELECTRIC

A combination of alternate layers of fullerboard and oil, consisting of four oil-soaked fullerboards separated by three paraffine oil sections, was tested. Results plotted in Fig. 4 show that the dielectric constant of a heterogeneous combination of oil and fullerboard (4.25) is greater than that of either component (3.32 for fullerboard and 3.69 for paraffine) taken separately and less than the sum of the two components. It may also be noted that the current, power factor, watts and dielectric constant increase with the temperature. At about 52 deg. C. there is a sudden increase in the rate of temperature rise due to a change in the physical properties of the oil at that temperature. Moreover, it was observed that the power factor of the heterogeneous combination was greater than that of fullerboard alone. Hence it appears that paraffine oil must have a large power factor at high temperatures. Since this seemed contrary to the usual belief, a dielectric loss test was made by hanging two parallel iron plates in an oil tank. This showed conclusively that the oil has a dielectric loss angle. Further experiments with aluminum plates showed that the dielectric loss angle of the oil is greatly increased by heating.







FIGS. 4, 5 AND 6—RELATION BETWEEN CURRENT, DIELECTRIC LOSS, POWER FACTOR, DIELECTRIC CONSTANT AND TEMPERATURE (TESTS ON ALTERNATE LAYERS OF PARAFFINE OIL AND FULLERBOARD ARE GIVEN IN FIG. 4; FIGS. 5 AND 6 REFER TO PARAFFINE OIL ALONE)

PARAFFINE OIL

Dielectric Strength.—To study the effect of change in temperature over a wide range some paraffine oil was frozen during an especially cold period and tested as it melted. The melting point (12 deg. C.) marked a transition point in the dielectric strength. Instead of decreasing with the temperature as would be expected, the dielectric strength[3] began to increase.

Experiments were made on the dielectric strength of paraffine oil at high temperatures by use of a standard air spark gap placed in a tank of oil. Each point on the curve in Fig. 5 represents the average of ten breakdown values at the same temperature. The broken lines show the probable shape of the curve based on the results at low temperatures. The testing frequency was 25 cycles. It may be observed that the curves obtained with different sparking distances are similar. However, the transition point[4] is 110 deg. C. with the larger gap, while with the smaller gap it occurs at 100 deg. C.

The most important results obtained from the experiments on the dielectric strength are that paraffine oil has a transition point at about 50 deg. C., and that the dielectric strength remains nearly constant at its maximum value from this temperature up to about 100 deg. C. At the latter temperature a third transition takes place and the dielectric strength falls off rapidly with an increase in temperature.

Heating of Oil Due to Dielectric Energy Loss.—Careful experiments showed that the heating of the oil due to dielectric energy loss does not affect the principal properties appreciably.

Dielectric Loss Angle.—It may be observed from Fig. 6 that above 48 deg. C. the power factor increases more rapidly with the temperature with the higher potential gradient than it does with the lower potential gradients. The writer believes that this is due to the increased heating effect caused by the higher potential gradient. However, this effect is a small one and does not account for the large difference in the observed angles measured at different voltages.

It may also be noted from the curves in Fig. 4 that the dielectric loss angle increases rapidly with the temperature, that the highest gradient gives the greatest dielectric loss angle, and that there is a transition point in the power-factor curves at about 49 deg. C. This transition point occurs at nearly the same temperature as that in the dielectric strength.

In previous experiments Pungs[5] discovered that paraffine oil has a large power factor at high temperatures. However, he was not able to detect a change in the dielectric loss angle due to an increase in the potential gradient which is so clearly shown in the experiments here discussed.

Dielectric Constant.—On account of the theoretical significance of the dielectric constant of paraffine oil, extreme care was exercised in measuring it. Contrary to expectations the dielectric constant of paraffine oil (Fig. 7) was found to increase with rise in temperature. Moreover, there is a transition point at about 50 deg. C., after which the dielectric constant increases still faster with the temperature.

It would also be of great theoretical interest if it could be shown that the dielectric constant changes with the potential gardient. The writer believes, however, that there is no such change (Fig. 7).

Currents in Paraffine Oil.—From Fig. 8 it may be observed that a transition point appears to occur in

[3]This observation had previously been made by Tobey, *Proceedings A. I. E. E.*, Vol. 29, 1910.
[4]T. W. Edmondson found that the dielectric strength of liquids was not directly proportional to the spark length.

[5]See L. Pungs, "Dissertation," Darmstadt, 1913; *Archiv für Elektrotechnik*, pp. 329-344, 1912; *Science Abstracts*, 16 B, No. 592, 1913.

the relation between the current and potential gradient at a higher temperature than for the dielectric loss angle. Upon analyzing the curves to see if the current is proportional to the voltage, an important result is revealed. If the currents are proportional to the voltage, the current at 4000 volts should be twice as great as at 2000 volts, and at 8000 it should be four times as great. The differences between the calculated and observed currents are given in the table printed on the opposite page.

The table proves that the current becomes proportional to the voltage at about 53 deg. C., which is the transition point for the oil. Below the transition this proportionality is departed from, the amount being greater the higher the potential used. From these results the conclusion is drawn that below the transition point there is not a sufficient number of ions to carry the current. The deficiency in ions increases indirectly with the temperature and directly with the potential used. Furthermore, the potential appears to cause the molecules to dissociate and form new ions. Since the currents below 53 deg. C. are strictly proportional to the temperatures, the dissociation appears to be proportional to the temperature. Hence it may be supposed that at the freezing point of the oil the mobility of the ions or the dissociation might be zero.[6]

The preceding ionic interpretations of results are strongly supported by the work of other investigators.[7] In this connection it is also interesting to note that Bedell and Kingsley[8] found a transition point in the insulation resistance of vacuum oil (a heavy paraffine oil) at 50 deg. C. They also found that the resistance of pure oils is a constant at any one temperature and decreases as the temperature increases.

Dielectric Energy Loss.—The dielectric energy loss is dependent on the characteristics of the capacity and the dielectric loss angle which have already been discussed. It may be seen in Fig. 9 that the loss is proportional to the temperature. Inasmuch as the dielectric constant is independent of the voltage, and since the dielectric loss angle increases with the voltage, the energy loss in paraffine oil increases faster than the square of the applied potential. When a temperature of 49 deg. C. is reached a transition point occurs.

Theory of the Dielectric Properties of Paraffine Oil.—The author believes that all of the dielectric properties of paraffine oil can be explained on the basis of the polarization and ionization. For instance, assume that the temperature increases indirectly as the polarization and directly as the ionization. Then the displacement current which depends on the polarization will decrease with rise in temperature, and the conduction current which depends on the ionization will increase. This relation appears to be in accordance with facts. The dielectric loss angle depends primarily on the polarization and consequently, to a certain extent, indicates its effects.

From a consideration of the analysis of the currents in oil it may be seen that the application of electrostatic stress causes an increased ionization in the oil. Above the transition point (50 deg. C.) ionization easily occurs, so that an adequate number of ions is provided to carry the current. Inasmuch as the dielectric loss angle increases at a more rapid rate above 50 deg. C., it appears that the polarization will decrease more rapidly after this point is passed. The higher rate of decrease in polarization allows the electrostatic stress to reduce the polarization more effectively through dissociation, so that the dielectric loss angle increases more rapidly above the transition point for any given potential.

Considerable light is thrown on the relative dielectric strengths of solids, liquids and gases by the works of other investigators.[9] Faraday points out, for instance, why the intensity of induction required for breakdown must be much higher in a fluid than in a gas and still higher in a solid than in a fluid. Thornton showed that the dielectric strength decreases as the frequency increases. The time element involved in the rupture of dielectric was pointed out by several researchers, Townsend saying that a certain number of ions must be formed by collision before discharge can take place. Chernyshoff and the writer showed that a low-frequency (60-cycle) discharge follows the shortest path, whereas at high frequency there is not sufficient time for ions to be formed by collision, so the discharge may follow a longer path.

The change of dielectric strength of the oil with temperature is satisfactorily explained by the ionization theory. The highest dielectric strength occurs when the ionic conduction begins to take place freely. From

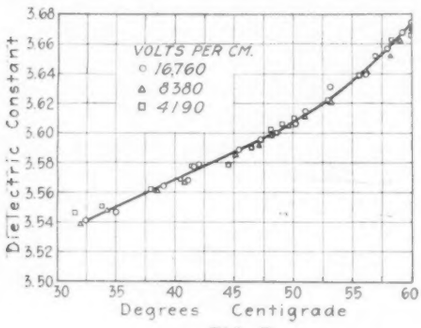


FIG. 7

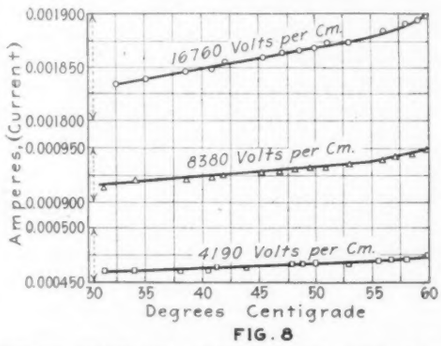


FIG. 8

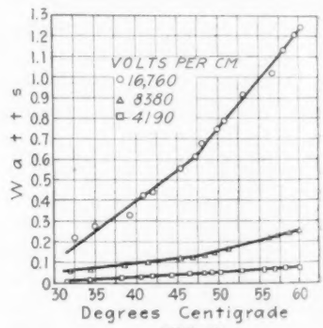


FIG. 9

FIGS. 7, 8 AND 9—VARIATION OF DIELECTRIC CONSTANT, CURRENT, AND LOSS IN PARAFFINE OIL WITH TEMPERATURE

[6] L. Maclès (*Comptes Rendus*, 151, p. 63, 1910) found that vaseline acts as a medium containing free ions whose mobility is zero in the semi-fluid state, but observable in the liquid state. In the same periodical (161, pp. 694-696, 1915) Maclès determined the conductivities of certain insulating liquids from the velocities of recombination, concluding that strong fields reduce the conductivity.

[7] Villemontée, *Journal de Physique*, 5 Ser., Vol. 4, p. 770, 1914; J. Carvallo, *Ann. de Physique* (9), 1, p. 171, 1914; G. Jaffe, *Le Radium*, 10, pp. 126-134, 1913; G. Szwessy and K. Schäfer, *Ann. der Phys.*, 35, 3, p. 511, 1911; H. J. Van der Bijl, *Ann. der Phys.*, 1, pp. 170-212, 1912, and C. H. Greinacher, *Phys. Zeit.*, 10, p. 986, 1909.

[8] *Physical Review*, 2, p. 185, 1895.

[9] Faraday, *Phil. Trans.*, January, 1838; Faraday, "Experimental Researches in Electricity," p. 446, Vol. 1; P. Zeeman, *Koninkl. Akad. Wetensch, Amsterdam Proc.*, 14, p. 650, 1912; W. M. Thornton, *Phil. Mag.*, Vol. 32, p. 242, 1916; A. Chernyshoff and C. A. Butman, *Electric Journal*, 1915.

this point to about 100 deg. C. the dielectric strength is nearly constant; thus it appears that the liquid is polarized, otherwise it would be difficult to see why the dielectric strength remained nearly constant as the temperature increased. However, if the liquid is polarized it would seem that the same stress would have to be applied until the polarization itself was changed. At the transition point of 50 deg. C. and at higher temperatures there are enough ions to carry the current and the ionic conduction protects the polarization. However, the curves of Fig. 5 indicate that the polarization decreases slightly as the temperature increases until about 100 deg. C. is reached, after which there is a rapid decrease in the dielectric strength. According to the preceding theory, the polarization should decrease rapidly as the temperature increased beyond 100 deg. C. This was proved by C. W. Ackerman,[10] who found that paraffine oil becomes a bad insulator at about 100 deg. C. In this connection it is interesting to observe from the two curves that the breakdown point of polarization occurs at the lowest temperature in the one in which the polarization decreases the fastest.

Below 50 deg. C., the polarization is protected less and less by the ionization until the freezing point is reached, at which point there are probably few if any mobile ions. Hence the freezing point (—12 deg. C.) marks the point of minimum dielectric strength. As the temperature is decreased below —12 deg. C. the oil assumes new physical properties in which the dielectric cohesion and consequently the dielectric strength is greatly increased.

CAUSE OF THE INCREASE OF THE DIELECTRIC CONSTANT WITH THE TEMPERATURE

It would be expected that the dielectric constant would decrease as the temperature increases because there is less matter between the condenser plates at high temperatures. For some substances[11] this is so.

However, in the case of paraffine oil it is not sufficient to take into account only the density, because the polarization and ionization are also important factors. The density and polarization both decrease with an increase of the temperatures, so that in the case of paraffine oil the cause of the increase of the dielectric constant must be due to the increase of the ionization with the temperature. When the molecules dissociate an increased stress appears in the ether which is due to the attraction of the free charged atoms. This makes it easier for the lines of the applied electrostatic stress to pass through the liquid, thereby increasing the dielectric constant. This factor appears to predominate over the other two.

The preceding view is confirmed by experiments which showed that the change of the ionization and the dielectric constant with the temperature run parallel. For instance, the point (50 deg. C.) at which increased ionization occurs is the point at which the dielectric constant begins to increase faster with the temperature. However, the dielectric constant is not dependent primarily on the conductivity, for a substance may have a dielectric constant apart from conductivity. For instance, the author tested a sample of micarta made by a special experimental process near its breakdown value (95.8 deg. C.). It was a conductor because the dielectric loss angle was nearly 90 deg., but it still had a dielectric constant which measured 34.37. At 65 deg. C. and with the same gradient the micarta had a dielectric loss angle of 21 deg. 39 min. 35 sec. and a dielectric constant[12] of 7.979. The difference between a dielectric and a conductor is clearly defined in the author's paper on the series inductance bridge.

NATURE OF A DIELECTRIC

Dielectric phenomena have to do primarily with the distribution and characteristics of polarized molecules; that is, molecules charged on one side positively and on the other side negatively. That the dielectric constant is a molecular property is shown by its direct relation to other purely molecular properties such as the index of refraction, dispersion, absorption and the capillary constant.

DIFFERENCE BETWEEN CALCULATED AND OBSERVED CURRENTS IN PARAFFINE OIL

Temperature (Deg. C.)	Observed (at 2000 Volts)	Calculated (at 4000 Volts)	Observed (at 4000 Volts)	Difference	Calculated (8000 Volts)	Observed (8000 Volts)	Difference
32.5	0.000460	0.000920	0.000915	−5	0.001840	0.001833	−7
37.5	0.000462	0.000924	0.000921	−3	0.001848	0.001843	−5
42.5	0.000464	0.000928	0.000925	−3	0.001856	0.001852	−4
47.5	0.000466	0.000932	0.000930	−2	0.001864	0.001861	−3
52.5	0.000468	0.000936	0.000935	−1	0.001872	0.001872	0
57.5	0.000471	0.000942	0.000943	+1	0.001884	0.001886	+2
60.0	0.000950	0.000950	0.000950	0	0.001900	0.001897	−3

A theory regarding the nature of polarization has been proposed by W. M. Thornton[13] which does not appear to be at variance with these experiments. He found that polarization, no matter how long continued or slow in action, is quasi-elastic in type. There are three stages. The first involves rapid changes and results in the rearrangement of the atomic charges within the molecule. During the remaining two stages an electrical strain is established throughout the mass under the new conditions of internal stress imposed by the first polarization.

In the case of gases and liquids an explanation of the dielectric phenomena must not be given on a static basis, but on a kinetic one. This is necessary because of the change of the dielectric constant with the temperature, the time necessary to produce electrostatic effects and the known movements of molecules in gases and liquids. Finally the properties of dielectrics may be influenced by their being ionized, as has been shown to be the case for paraffine oil in the foregoing experiments.

The experimental part of this paper was done at the high-tension research laboratory of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., of which C. E. Skinner is director.

[10] "Dissertation," Göttingen, 1914; *Ann. der Physik* (4), 46, p. 199, 1915.

[11] M. A. Lorentz (*Ann. der Phys.*, 9, p. 641, 1880) proposed to represent the variation of the dielectric constant K with the density d by the formula $[(K-1)/(K+2)] \times 1/d = \text{constant}$, which has been verified recently by A. Occhialini, *Nuovo Cimento*, 7 Ser., 6, pp. 108-126, 1914.

[12] F. Sanford (*Science*, pp. 759-760, May 26, 1916), presents the dielectric constant of certain metals. E. A. Harrington ("Dissertation," Clark University, *Physical Review*, Vol. 8, p. 591, 1916) states that water has a dielectric constant "entirely independent of the conductivity."

[13] *Phil. Mag.*, 19, p. 390, 1910.

Over the Top—Buy Liberty Bonds

PRESENT CONSTRUCTION AT WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY'S NEW PLANT

New Works of the Westinghouse Company

Plant at South Philadelphia, Started in 1917 and Now in Partial Operation, Designed for Eventual Expansion to Size Comparable with East Pittsburgh Works

FROM a plowed field less than a year ago to an industrial plant embracing at present seven large buildings and employing over 1800 people, engaged in manufacturing ship-propulsion machinery for the government, is the record at the new South Philadelphia works of the Westinghouse Electric & Manufacturing Company.

The East Pittsburgh plant began operations in 1895 with about 2000 employees, and it now employs in the neighborhood of 25,000 people and occupies more than 100 acres (40 hectares) of floor space, a development beyond which it was not deemed to be practicable to expand.

After thorough investigation of available sites during the summer of 1916, the property at Essington, or South Philadelphia, was chosen. The land, embracing 500 acres, is on the Delaware River, in Delaware County, Pennsylvania, 9 miles (14.4 km.) south of Broad Street Station, Philadelphia, adjoining the Hog Island shipyard of the American International Corporation. It is reached by the Philadelphia & Reading and Pennsylvania railroads and by the Chester short line of the Philadelphia Rapid Transit Company. Its location on the river, on which there is a frontage of 4500 ft. (1371 m.) also affords another means of transportation, though as yet no docks have been built.

This location insures adequate fresh water for powerhouse operation and tests on the turbines and auxiliaries to be built.

Construction was begun early in 1917. In November the plant began operations on a small scale, and these operations have been gradually increasing.

The entire activities at present are devoted to the manufacture of steam turbines, condensers, gears and other accessories used in the equipment of ships, the most vital immediate need of the government. Marine propelling machinery is being built for the Submarine Boat Corporation and the Merchant Ship Building Corporation as agents for the Emergency Fleet Corporation. Turbines and reduction gears are also being built for use by the United States Navy on torpedo-boat destroyers.

It is expected that eventually the plant will be expanded until it is comparable with the East Pittsburgh works. A portion of the tract has been set aside for a town site that will afford space for approximately 5000 people.

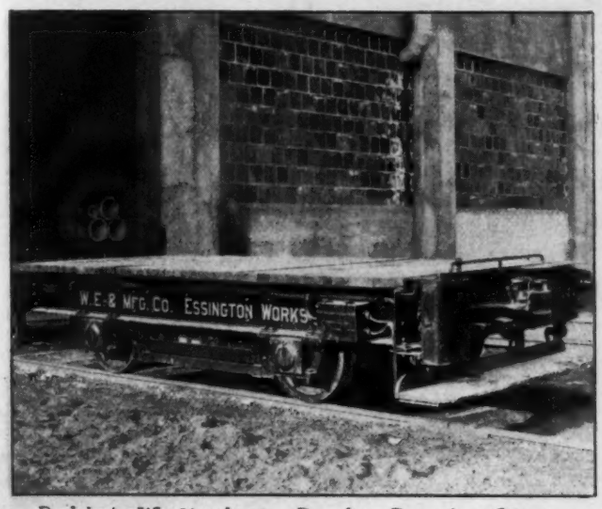
Already seven buildings have been erected. These include the pattern storage shop, foundry, forge shop, power house, erecting shop and two machine shops, representing over 600,000 sq. ft. (55,200 sq. m.) of floor space.

Practicing a policy consistently advocated by the company, the management determined to use central-station power. This energy is supplemented by the company's own power plant.

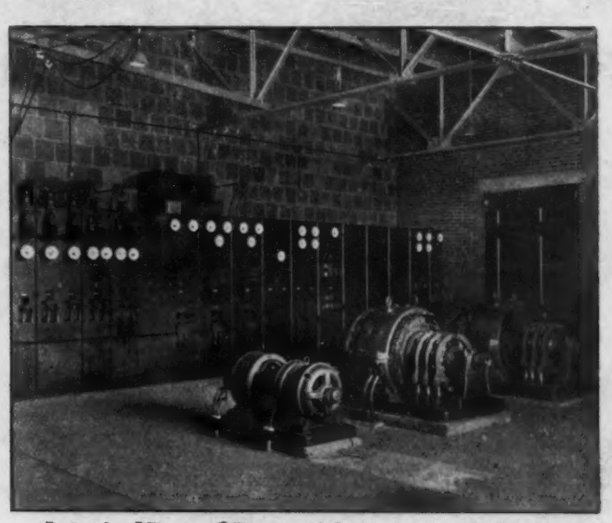
The demand on the Philadelphia Electric Company, which supplies this district, is naturally greater in winter than in summer; it has a surplus capacity in the latter period. On the other hand, the Westinghouse company requires steam heat at from 2 lb. to 4 lb. (140 to 280 grams per square centimeter) pressure for heating buildings during the winter, but requires no steam during the summer except for testing. Steam for heating can be most economically supplied by passing it through a non-condensing turbine and then to heating mains after it has done its work in power generation. An arrangement satisfactory to both companies was entered into by which the Philadelphia Electric Company supplies the works with energy during the summer, and in the winter energy will be generated in the power plant at the works, which, on account of the exhaust steam being utilized, is operated non-condensing. This arrangement affords a reserve source of power, and, when necessary, the local plant may pump back power into the central-station system.

Selection of the site and general direction of the plant activities have been in charge of H. T. Herr, vice-president Westinghouse Electric & Manufacturing Company, who also superintended the securing of all the equipment.

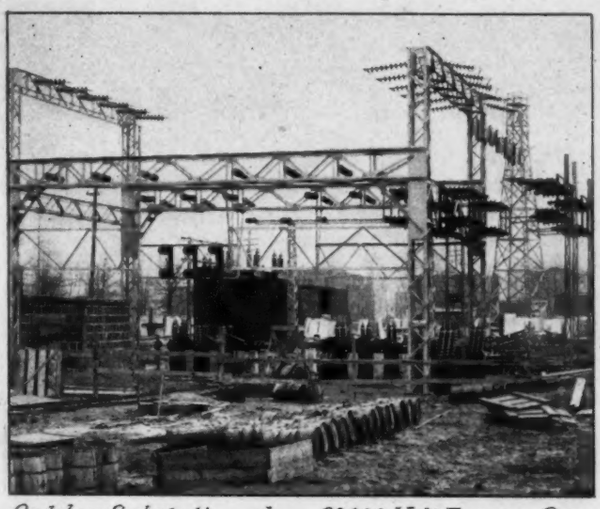
Business relations with Westinghouse, Church, Kerr & Company, who are constructing the plant, were handled by Calvert Townley, assistant to the president, technical arrangements being subject to Mr. Herr's approval. As assistant to Vice-president Herr, R. B. Mildon had general supervision of construction and the providing of equipment, as well as its operation. All arrangements have been subject to the approval of E. M. Herr, the president.



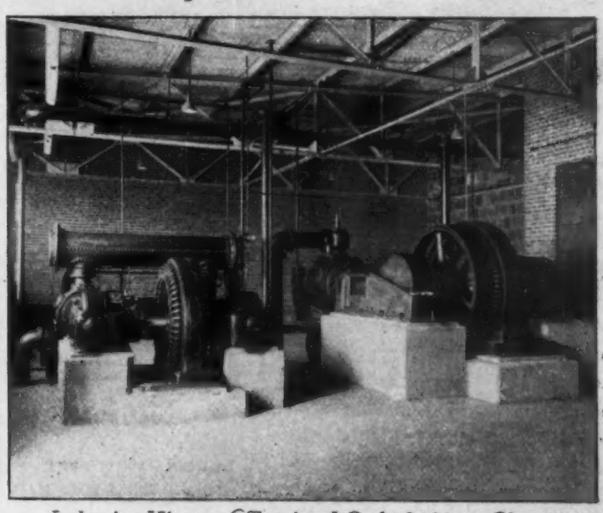
Baldwin-Westinghouse Burden-Bearing Storage Battery Truck with a Capacity of 50 Tons



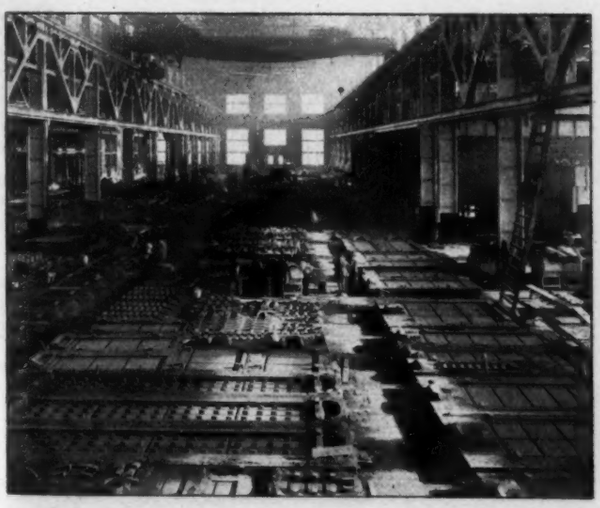
Interior View of Typical Substation, Showing 250-Volt Rotary Converters and Switchboard



Outdoor Substation where 60,000-Volt Energy from Philadelphia Electric Co. is Transformed to 6,000 Volts



Interior View of Typical Substation, Showing Synchronous Motor Driven Air Compressors



Interior View of the Foundry

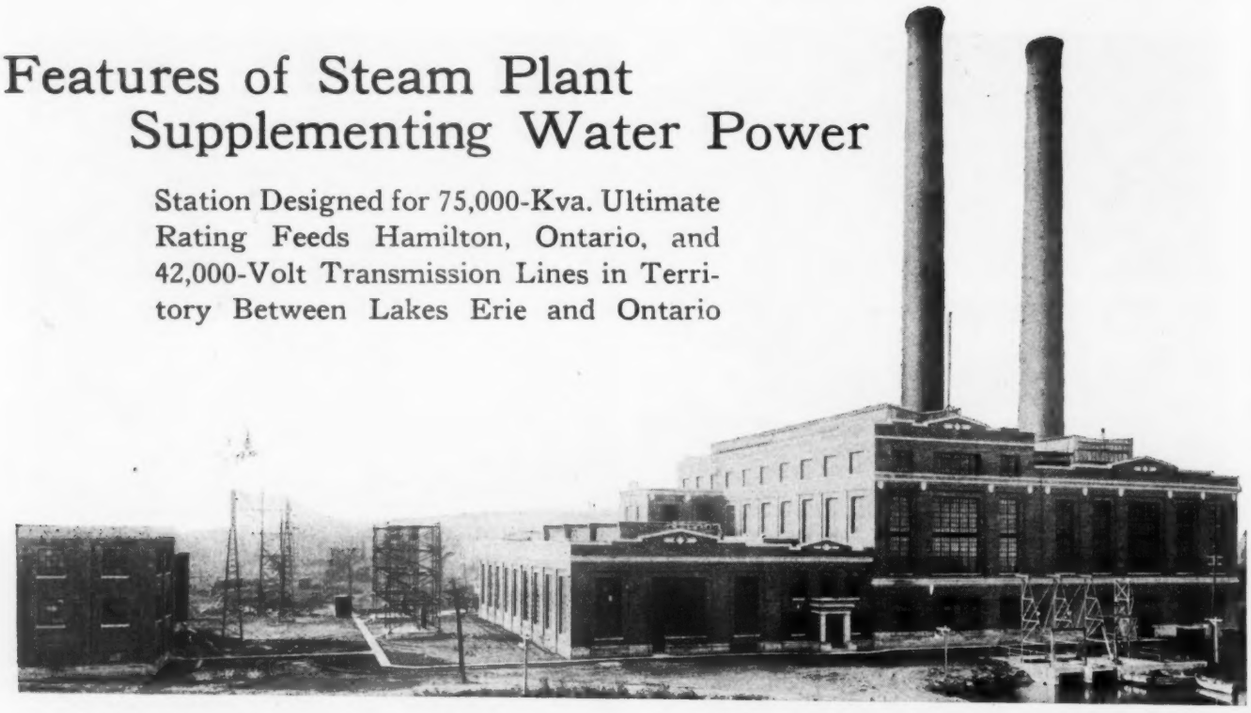
Interior View of No. 2 Machine Shop, Showing Type of Construction, Galleries and Overhanging Balconies

South Philadelphia Works, Westinghouse Electric & Manufacturing Co.

DETAILED VIEWS OF WORKSHOPS AND OUTDOOR EQUIPMENT

Features of Steam Plant Supplementing Water Power

Station Designed for 75,000-Kva. Ultimate Rating Feeds Hamilton, Ontario, and 42,000-Volt Transmission Lines in Territory Between Lakes Erie and Ontario



A 75,000-KVA. steam generating plant, known as the East End power station, has been built recently by the Dominion Power & Transmission Company, Ltd., at Hamilton, Canada, to supplement its hydroelectric plant at Power Glen. The new station is designed for continuous and even independent operation at high fuel economy and is not intended solely for use as an emergency standby station. It is situated on the Lake Ontario waterfront, where plenty of condensing and boiler-feed water as well as fuel is available.

At present the company's chief source of energy is the hydroelectric station at Power Glen. This plant is situated about 35 miles (56.3 km.) from Hamilton, on the Welland Canal, and develops its power from water taken from Lake Erie under a head of 265 ft. (80.8 m.). Power is supplied to subsidiary companies in the Welland, St. Catharines, Thorold, Port Colborne, Grimsby, Dundas, Brantford, Oakville and Hamilton districts, the largest portion going to the city of Hamilton. So as to minimize interruptions to service three separate lines operating at 45,000 volts are employed to connect the Power Glen plant with the main switching station at Bartonville, a suburb of Hamilton. The accompanying map shows the district served by the Dominion Power & Transmission Company and also the proximity of the newly completed steam plant to the load center of the system.

While the steam station is designed for 75,000-kva. ultimate rating, only 25,000 kva. has been installed so far. The station delivers energy to the 45,000-volt lines of the company, but in addition is designed to fulfill the requirements of a step-down transformer station, as 13,000-volt energy has to be distributed to neighboring factories. Half of the 25,000-kva. step-down equipment is installed.

During the winter months it is necessary to house the coal-hauling equipment, so a separate building is provided for this purpose into which the cars are run and unloaded into a large receiving hopper. From this hopper the coal is fed to a crusher and then elevated by an inclined conveyor to storage bins above the boilers. From these it may be fed by gravity into a traveling hopper, which weighs it and delivers it to the stokers.

The boilers (1050 hp. each), which are of the Edge Moor type, are equipped with eleven-retort Taylor underfeed stokers and radial brick chimneys 240 ft. (73.2 m.) high, a combination which will allow the boilers to be forced to 300 per cent normal rating if necessary. Automatic soot blowers and boiler-room instruments which will permit the engineers to operate the boilers intelligently are provided. Make-up water for the plant is obtained from Burlington Bay and is treated by the We-Fu-Go system, the apparatus being situated in a separate building.

FIG. 1—TERRITORY SERVED BY DOMINION POWER & TRANSMISSION COMPANY

Each of the turbine generators, which are of the Westinghouse Parsons-Curtis type, is supplied with steam from its own set of boilers through piping run through the basement wall. The piping is arranged so that one set of spare boilers is sufficient for the entire plant. Steam is delivered to the turbines at 200 lb.

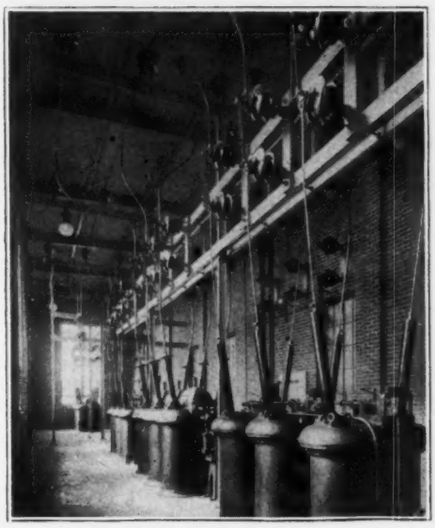


FIG. 2—SOME OF THE 42,000-VOLT OIL SWITCHES AND DISCONNECTING SWITCHES

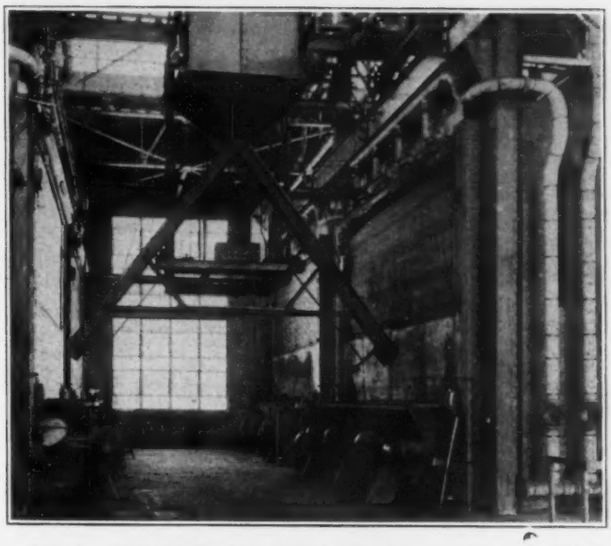


FIG. 3—COAL-WEIGHING LORRY FEEDING BOILERS ON EACH SIDE OF AISLE

FIG. 4—6600-VOLT BUS STRUCTURE

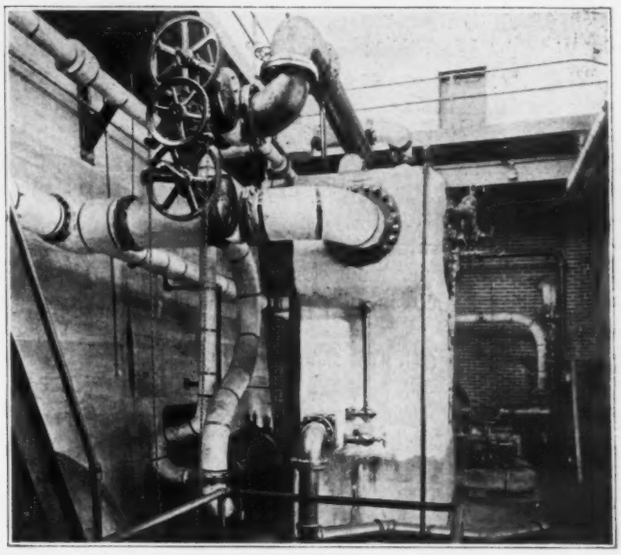


FIG. 5—OPEN-FEED WATER HEATER RECEIVING STEAM FROM AUXILIARIES

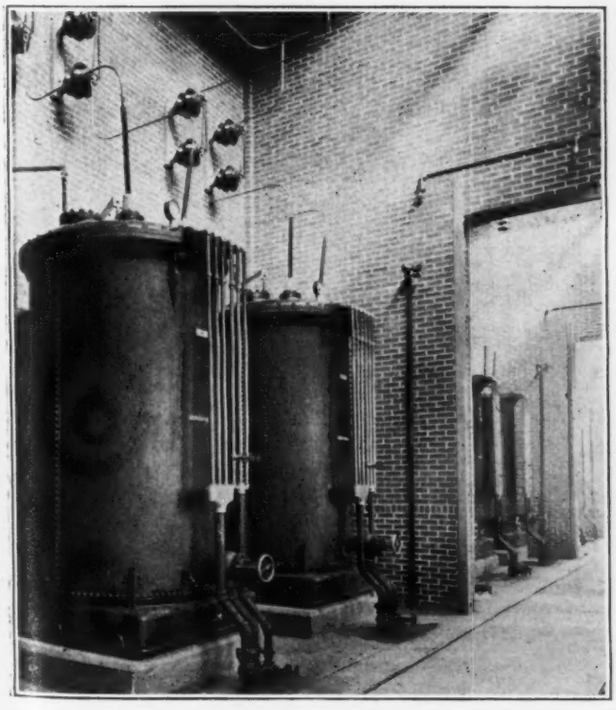


FIG. 6—PART OF 6600/42,000-VOLT TRANSFORMER BANK

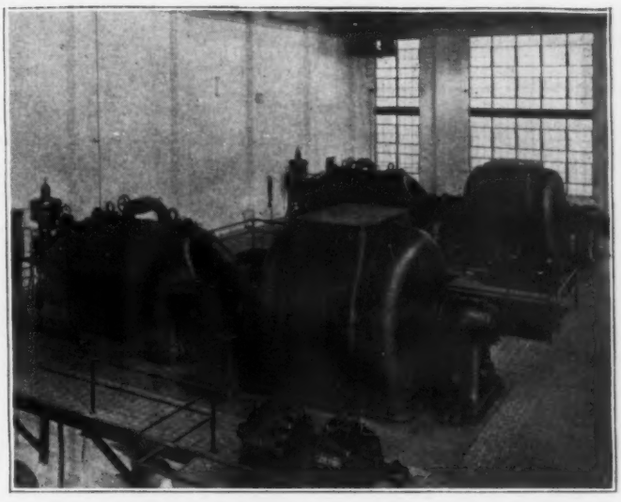


FIG. 7—MAIN GENERATORS AND MOTOR-DRIVEN EXCITERS

(14.1 kg.) pressure and 160 deg. superheat. Surface condensers are installed immediately below each turbine, the condensate and air being withdrawn by pumps coupled to an impulse turbine. Cooling water for the condensers is also taken from Burlington Bay, the pumps being installed below the water level so as to be self-priming. Exhaust steam from the turbines driving the auxiliaries is admitted to Cochrane open-type feed-water heaters. The boiler-feed pumps are also turbine-driven, and each one is large enough to feed four boilers under maximum load.

The turbines drive 12,500-kva., 6600-volt, three-phase, 66⅔-cycle generators, which are cooled by air treated in Carrier humidifiers. Two humidifiers will be provided for each set of three generators. Each generator is separately excited by a motor-driven exciter, although a steam-driven exciter is also available for any machine in case of necessity.

Transmission of Power

Energy from the generators is carried by twelve 500,000-circ. mil lead-covered cables to switches in the control room and then to 6600/42,000-volt transformers which are interconnected on the high-voltage side. With this arrangement two sets of transformers are always between each pair of machines and disturbances are localized in case of trouble in any one of the generators. Power, which must be transmitted at 6600 volts, is not taken directly from the generators but from the 42,000-volt bus through step-down transformers. Energy for station service, however, is taken directly from the generators through step-down transformers. The station-service buses are sectionalized in order that equipment which is used exclusively with each generator may be operated therefrom. Provision is made for supplying general station service from any generator.

All of the electrical apparatus is remotely controlled from the operating room, which overlooks the turbine room. A signaling system, consisting of Klaxon horns and illuminated signs, is provided whereby signals may be exchanged between the boiler room, engine room and control room. Each unit has its individual signal pedestal.

As shown by the cross-section of the plant, the switching and transforming equipment is installed in a low building adjoining the power plant. Views of the 42,000-volt oil-switch room, a section of the 6600-volt bus compartments and the transformer bays are shown in accompanying illustrations. Two transmission lines pass through the roof and carry energy to the main switching station at Bartonville. The lightning arresters protecting the steam station are installed beneath the terminal structure just outside the switch house.

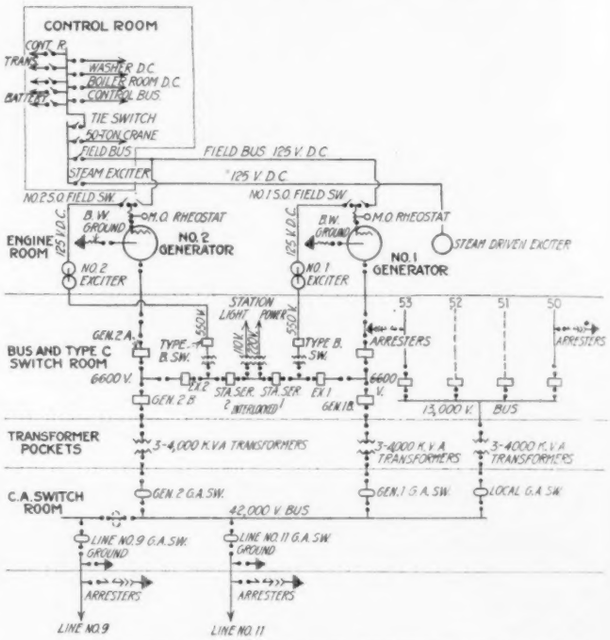


FIG. 8—TRANSFORMERS TIED TOGETHER ONLY ON HIGH-TENSION SIDE

The plant was designed and built by the company's organization of which W. C. Hawkins is chief engineer and managing director, George Service is mechanical engineer and Charles H. Hutton electrical engineer.

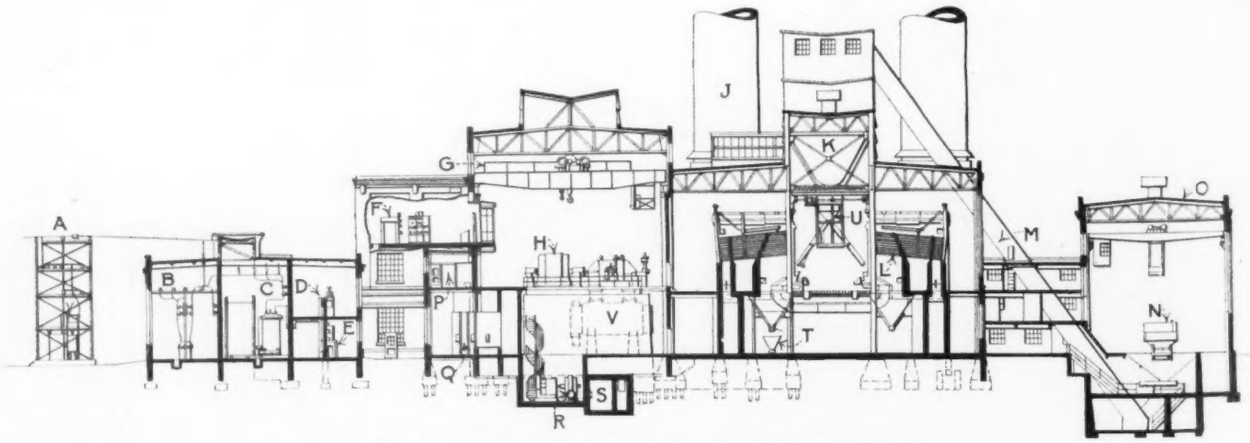


FIG. 9—CROSS-SECTION OF HAMILTON (ONT.) STEAM PLANT

A—42,000-volt arresters; B—42,000-volt reactance circuit breakers; C—three 4000-kva. transformers per generator; D and E—6600-volt circuit breakers and bus structure respectively; F—control room; G—50-ton crane; H—12,500-kva. turbine-generator; J—smokestack; K—420-ton coal bunker; L—1050-hp. boilers; M—60-ton elevator; N—coal cars; O—coal shed; P—lavatory; Q—humidifiers for generating ventilating air; R—condenser circulating pump; S—cooling water tunnel; T—ash car; U—5-ton lorry; V—condenser.

Make the World Safe—Buy Bonds

Solving Woodworking Drive Problems

Method by Which One Company Has Practically Eliminated Repairs and Reduced Power Bills by the Proper Selection of Drives and Correct Mounting of Motors

BY W. A. BLACK
Engineer Fairbanks, Morse & Company

WOODWORKING is one industry in which the advantages of motor drive over shaft and belt drive are very marked. Electric drive is especially desirable because the machines can be located for the most convenient handling of the products and because long shafts will be required with group drive if the machines are scattered to permit the piling of stock and finished products. Furthermore, much of the machinery is used intermittently for comparatively

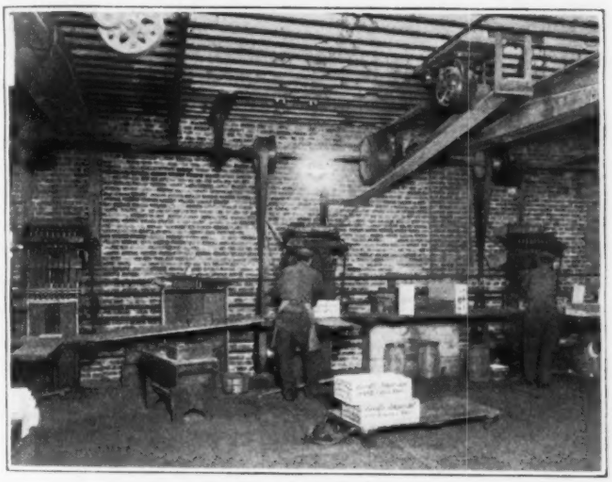


FIG. 1—GROUP-DRIVEN BATTERY OF NAILING MACHINES

short periods, resulting in considerable transmission loss if shaft and belt drive is used.

All these conditions in a line-shaft-driven plant tend to increase the power lost in transmission, because the long lines of shafting must be run continuously in order that power may be available for all machines when it is wanted, though comparatively few are in operation at one time. This loss is increased by the friction of loose pulleys on machines that are not working. With a motor-driven plant having for most purposes individual drive transmission losses are very small because they are almost directly proportional to the number of machines that are doing useful work.

The conservation requirements of the present time have shown that the electric drive alone is not sufficient, but that the type of motor chosen and the method of drive used must be designed for the highest efficiency.

WHERE GROUP DRIVE WAS ADVISABLE

The Riddle-Rehbein Manufacturing Company of St. Louis has laid out its drives with such care that practically all objectionable features of the ordinary woodworking plant have been eliminated and energy bills are less than for similar plants of smaller output. In most cases individual drives are used, as with this method the motors remain idle except at such times as the machines are in use.

In planning the drive it was found that there were certain places where individual drive would not be economical. For instance, the battery of nailing machines shown in Fig. 1 were arranged for group drive because a careful study showed that the load is intermittent and that seldom more than one machine is required to do actual work at any one instant. If individual drive had been used, a 2-hp. motor would have been required for each machine and the motor would have been loaded only intermittently, giving a very low load factor with its resultant low power factor and efficiency. With the arrangement adopted a 5-hp. motor drives the battery of five nailers, running with approximately steady load at approximately full load and giving a higher power factor and efficiency than the small machines even had they been operating at full load.

Another factor influencing the choice of group drive was that in this work the machines are never operated as individual units, but each machine performs its part of a progressive operation. The machines are used for making boxes, two end machines being used for framing the boxes, the next two machines for nailing sides, and the center machines for nailing the bottom of boxes coming from each side. The boxes finished by center machine are loaded on a truck placed within reach of the operator.

VALUE OF SUBSTANTIAL FOUNDATIONS

The 30-in. (76-cm.) double surfacer shown in Fig. 2 is direct connected to a 50-hp., 1200-r.p.m. induction

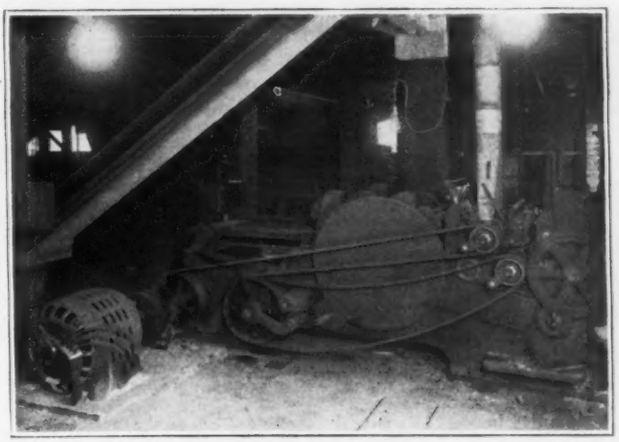


FIG. 2—30-IN. DOUBLE SURFACER DIRECTLY CONNECTED TO 50-HP., 1200-R.P.M. RALL-BEARING MOTOR

motor. The planer and motor are mounted on I-beams embedded in a concrete foundation which extends through basement into solid ground. Six hundred and fifty cubic feet (18.2 cu. m.) of concrete was used in the foundation, but the expense of making it is well offset

by the freedom from vibration and the perfect alignment maintained thereby. The advantage of a firm foundation cannot be overestimated, especially for direct-connected machines. The foundations should be large enough to accommodate both the machine and the driving motor, as failures have occurred where a machine and the driving motor were mounted on separate foundations, owing to foundations moving with reference to each other and thus throwing the machines out of line.

FIG. 3—TWO-SPINDLE SHAPER BELTED TO TWO VERTICAL MOTORS; BELT-DRIVEN BAND SAW IN FOREGROUND

The advantages of a solid foundation for maintaining perfect alignment are well illustrated by the performance of a 54-in. (137-cm.) resaw, which was mounted on a substantial foundation and directly connected to a 35-hp., 600-r.p.m. motor. After being in service over four years, the machine, with a tension of 2000 lb. (907 kg.) on a saw, would run for two minutes and thirty seconds after the power was shut off. With a less substantial foundation the heavy machine would have vibrated out of line and the strain on the bearings would have caused excessive repair expenses.

Direct-connected ball-bearing motors reduce the maintenance expense cost to a minimum. There are no belts to slip, break or be taken care of. The ball bearings are contained in dust-proof inclosures requiring only infrequent attention compared with other types. With such motors and bearings the greasy dust so prominent in most woodworking plants can be avoided. Furthermore, the absence of oil and grease on motor frame and windings makes it possible to clean the machines by blowing off the dry dust. For the purpose of cleaning machines the woodworking company has a small motor-driven air compressor which is in use only when the cleaning is necessary.

While machines which are belted to motors mounted on the ceiling have all of the advantages of individual drive, they have the disadvantage that the belts obstruct the light. In addition, since the belts are long, they require more attention and are harder to cover with protective guards. To overcome these objections many of the motors in this plant were mounted on the ceiling under the driven machine and a belt was run through an opening in the floor. This arrangement had all the advantages of ceiling mounting and at the same time permitted the use of short belts that could be easily protected by guards. No changes were necessary in the bearing construction as ball bearings were used and only occasional attention is required. With this type of drive it was necessary to guard against the use of excessively short belts and against the location of motors directly under driven pulleys, as these conditions would reduce the area of contact of belt on pulleys.

Vertical Shaft Motors for Shapers

A very practical drive shown in Fig. 3 was adopted for the two-spindle shapers used in this plant by belting them to two 3-hp., 1800-r.p.m. vertical motors. The starting switches are mounted on side of machine opposite the motor within reach of the operator. Either or both spindles can be readily started or stopped as required. The use of vertical motors eliminates the need of crossed belts, and the ease with which spindles can be started and stopped reduces the tendency for the operator to leave spindles in operation when not in use.

On a small jig-saw used for cutting out ornamental work the lines of which have to be followed very closely a unique arrangement is used to keep the work free from sawdust. A small ball-bearing motor is belted to a blower, which in turn is connected by flexible tubing to a nozzle placed close to the work. The air from the blower is forced through the nozzle, which blows all sawdust from the work and leaves the lines visible.

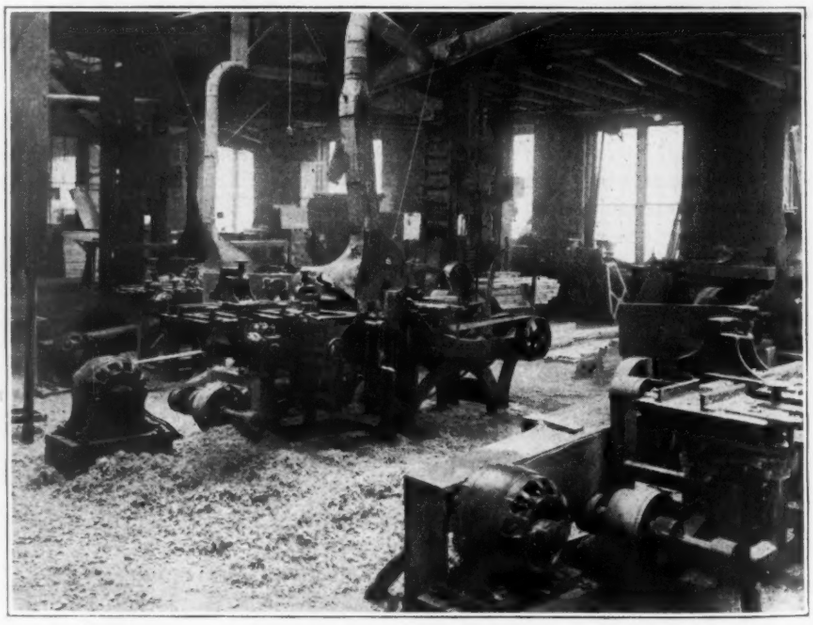


FIG. 4—GROUP OF SMALL MOLDERS BELTED TO BALL-BEARING MOTORS

Some small molders belted to ball-bearing motors are shown in Fig. 4. For this illustration the motor covers were removed to give a clear view of the motors. It is worthy of mention in this connection that with ball-bearing motors it is practicable to cover the motors as it is not necessary to remove the covers frequently for oiling.

A drive which required careful consideration before is was successfully worked out was that of a Linderman automatic dovetail glue jointer driven by a 15-hp., 1200-r.p.m. motor. In cold weather the high torque necessary to start required either a larger-size squirrel-cage motor or a motor of the wound-rotor type. With the larger squirrel-cage motor the starting current would have been objectionable and the power required would have only lightly loaded the motor after the machine had attained full speed. The wound-rotor type of motor with a secondary starter would have overcome the difficulty of operation but would have imposed the necessity of more care owing to slip rings, brushes and starter contacts.

The drive was very successfully taken care of with an internal starter motor. With this motor it was possible to obtain a high starting torque with a low starting current in a reasonably short starting period. The starting switch was simply a single-throw switch, and slip rings and brushes were eliminated. The installation has been in operation for over three years and has given perfect satisfaction.

A great deal has been written about the proper methods of mounting and the correct drive for the different classes of machines. In the above article the writer has endeavored to show how one company practically eliminated repairs and reduced power bills by the correct drive and by the correct mounting of its machines. What it has done can be equaled by any other company.

Lend a Hand—Buy Liberty Bonds

ACCOMPLISHING REDUCTION OF DUCT TEMPERATURES

Results of Investigation Carried On in Order to Determine How Effective Air Blowers Are in the Cooling of Cable Ducts

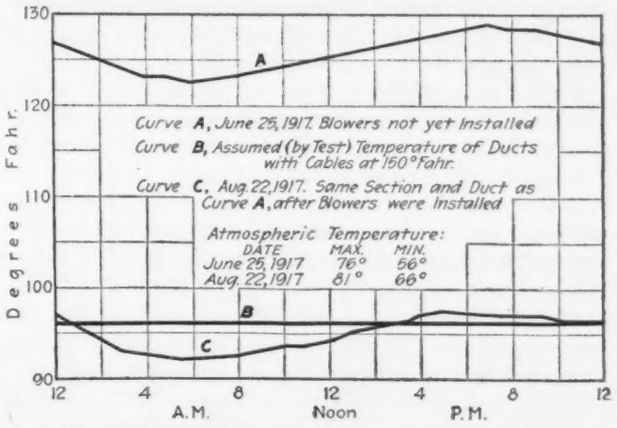
INVESTIGATIONS to determine how much air blowers can reduce the temperature of ducts used for high-voltage transmission cables have been made by William Keating and Carl H. Mueller of the Duquesne Light Company of Pittsburgh, Pa., some of the conclusions being presented herewith. Study along this line was precipitated by a rapid increase of load on the company's 11,000-volt system which caused whole sections of the duct line to become so badly overheated that numerous cable failures occurred.

In commenting on the subject of safe operating temperature the investigators pointed out that cables must operate at a much lower temperature than any other kind of electrical apparatus to assure reliable service. It has been definitely determined by laboratory tests that the maximum safe working internal temperature of an 11,000-volt cable is 150 deg. Fahr. (65.6 deg. C.). Beyond that temperature a peculiar phenomenon is manifested. By reason of the high voltage a hysteresis effect occurs in the insulation that generates heat. Up to 150 deg. Fahr. this loss increases directly with the temperature, but after 150 deg. Fahr. is reached the curve takes a very sharp upward turn and quickly reaches the failure point. Safe operation depends, therefore, upon the ability to keep the internal cable temperature below 150 deg. Fahr. By laboratory tests it has been determined that the difference in temperatures between the duct wall and the copper of the cable is approximately 54 deg. Fahr.

FACTORS AFFECTING CABLE LOAD

The number of cables in a given duct line and the character of the soil through which the ducts run are factors that determine the amount of load the cables can carry. The characteristics of the soil determine the rapidity with which the heat can be dissipated, while the number of cables determine the amount of heat to be dissipated. In general 35,000 kva. is the maximum load any duct line should be called upon to carry. Several parts of the Pittsburgh system have exceeded this safe maximum. It is at these points that trouble has developed.

In one section where trouble occurred there are ten tile ducts, built two wide and five deep, in which there are installed eight No. 4/0 three-phase, 11,000-volt cables. The street is narrow and its soil has poor heat-dissipating qualities. Several rolling mills with annealing furnaces are close to the street. Every cable


130
120
110
100
90
Degrees Fahr.
A
B
C
Curve A, June 25, 1917. Blowers not yet Installed
Curve B, Assumed (by Test) Temperature of Ducts with Cables at 150° Fahr.
Curve C, Aug. 22, 1917. Same Section and Duct as Curve A, after Blowers were Installed
Atmospheric Temperature:
DATE MAX. MIN.
June 25, 1917 76° 56°
Aug. 22, 1917 81° 66°
12 4 8 12 4 8 12
A.M. Noon P.M.

CABLE TEMPERATURES WITH AND WITHOUT BLOWERS OPERATING

in the run is called upon to carry from 200 amp. to 220 amp. during the morning and evening peaks. In the summer the load factor is about 50 per cent and in winter about 75 per cent.

WATER VERSUS AIR FOR COOLING

During the summer of 1916 there were thirty-eight cable failures in this section, which is somewhat less than a mile long. All these failures occurred between June 1 and Oct. 1; in other words, during the hot weather. In order to relieve the situation, the manhole covers were removed and left off day and night during this period. During the winter of 1916-1917 plans were formulated for the coming summer for cooling this section if it should be found necessary. Two plans were discussed—first, cooling by circulating water; second, by air from motor-driven blowers. The first idea was abandoned on account of the danger of cable failures from electrolysis, a trouble which has always been prevalent in this district.

At first the use of air blowers was not very favorably looked upon, as there were so few vacant ducts in the subway that there was very little free air to move. However, as this was the only plan left it was decided to try it out. Therefore eleven blowers, each having a capacity of 612 cu. ft. (17.1 cu. m.) per minute, were built into wooden frames to fit the manholes. Rubber-

covered wire was run through one of the spare ducts to supply energy to operate the blowers. At first the blowers were arranged to draw the air out of the duct line, but this overloaded the motors on account of the restriction of the passage of air through the duct line. The process was reversed and outside air forced into alternate manholes, the intervening holes being left open to allow the escape of the hot air. The effect produced is shown graphically in the accompanying curve. The average maximum temperature during the summer, with the blowers running, was 96 deg. Fahr. (35.6 deg. C.), which is just within the safe operating temperature.

By October the weather had become considerably cooler, so it was decided to shut down the blowers and close the manholes. This was done, and within a week the temperature had increased from 96 deg. Fahr. to 119 deg. Fahr. (35.6 deg. C. to 48.3 deg. C.). The manholes were opened and the blowers replaced. This increase, occurring as it did during cool weather, is due to the higher load factor on the cables. As the load is constantly increasing it may be possible that the blowers will have to be operated until the arrival of very cold weather.

Only two breakdowns have occurred in this section since the blowers were installed, and these were due to individual overloads on the cables caused by station failures at other parts of the system.

While the use of blowers is, no doubt, largely responsible for the decrease in the number of failures, the weather was cooler during the summer of 1917 than 1916. Furthermore, the load was slightly less, owing to the increase in the capacity of the transmission system at other points. The neutral has also been grounded, and this, it is believed, has aided in decreasing the number of failures in general as the voltage between conductors and ground has been decreased from 11,000 volts to approximately 6800 volts.

METHOD OF DETERMINING DUCT TEMPERATURE

The method of determining the temperatures in duct lines may be of interest and hence is given here. Several indicating pyrometers, depending on the change of resistance in a small coil, were purchased and drawn into the duct lines at the ends of 250-ft. (76.2-m.) leads. These instruments read within 2 deg. of accurate and are rugged enough to stand the service required of them. With these instruments surveys were made of all duct lines which might possibly become overheated and records kept of the temperatures. By this means the investigators have been able to determine where duct lines are already loaded to maximum capacity and thus to say where no more cables should be installed. Recording pyrometers built on the same principle as the indicating instruments were also used, but with little success. Such instruments were found so extremely delicate that they would not stand the service required of them. A number of twenty-four-hour charts were obtained at danger points, but the instruments could not be placed in regular service.

There is much to be done yet in the way of experimenting to secure data on which conclusions can be based. Heretofore this company has been restricted to the use of laboratory data compiled by cable manufacturers, which at best can only approximate actual conditions.

Bonds Are a Pledge—Buy Them

BUREAU OF STANDARDS AND ILLUMINATING ENGINEERING

Dr. M. G. Lloyd Addresses Chicago Meeting on Relation of the Bureau to Illuminating Engineering —New Federal Lamp Specifications Given

In an address entitled "Relation of the Bureau of Standards to Illuminating Engineering," Dr. M. G. Lloyd of the bureau's engineering staff, Washington, D. C., presented to the Chicago Section of the Illuminating Engineering Society a thorough and valuable review of the activities of the bureau most interesting to illuminating engineers. The paper contains an analysis of the field of the illuminating engineer, an outline of the work of the Bureau of Standards, a discussion of the standards for the measurement of light both in this country and abroad, a statement of the bureau's work to determine a standard in color specifications, a detailed description of the bureau's method of testing lamps purchased by the government, a tabulation of the new government lamp specifications, a discussion of the properties of gas-mantle lamps, an analysis of the bureau's work in testing automobile headlight lenses, a description of an extensive investigation carried out to determine the sensibility of the eyes of different individuals to light of different colors, and a statement of the bureau's activities in connection with public utility standards.

In discussing the scope of the illuminating engineering field, Dr. Lloyd said: "Illuminating engineering involves not only the application of physics, but it must consider also the physiology and psychology of light; that is, the relation of light to the human being. Illuminating engineering also involves architecture, interior decoration, hygiene and therapeutics. The work of the illuminating engineer requires the adaptation of light from all available sources to all purposes to which it may be applied. The available sources include both daylight and artificial light from bodies made incandescent by heat or by the application of electrical energy."

After discussing in detail the equipment and methods used by the bureau to test lamps purchased by the federal government, Dr. Lloyd gave data on life testing and federal lamp specifications. These specifications are to be issued later as Circular 13 of the Bureau of Standards. They must be complied with in the case of government purchases of multiple incandescent lamps and are available to all private purchasers who wish to follow similar specifications.

In the discussion of public utility standards, Dr. Lloyd stated that the investigation of the bureau on the subject of street lighting has been delayed by the war and probably will not be completed until after the war's termination. The bureau has recently been engaged in helping to formulate safety standards for application in federal industrial establishments such as navy yards and arsenals. Among the standards are included requirements for illumination in these establishments.

Invest by Buying Liberty Bonds

Finding Best Character of Community Rate

Discussion of the Advantages of the Method Employed by the Public Utilities Commission of Illinois in Approaching a Decision on This Matter—Tabulated Data Showing How Conclusions Were Arrived At

BY BERT H. PECK*

Electrical Engineer State Public Utilities Commission of Illinois

HAVING prepared and presented data on the value of property, the next thing with which the engineer must supply the commission in a rate case is information bearing upon the character of the rates best suited to give the revenues which may be determined upon. The methods of the State Public Utilities Commission of Illinois for handling this work are unique and offer some elements of advantage over others which may be employed.

The determination of the specific rates applicable in a given instance presents a question having two aspects: first, the question arises as to the character of rates best suited to meet the conditions prevailing in a given case; second, the question arises as to specific numerical rates of the character determined upon which will give the certain revenues desired.

The Illinois commission early realized this fact and has always endeavored to secure opinions from the utility involved, from responsible representatives of the community concerned and from its own experts as to the character of the rate which is best suited to the particular conditions that prevail. The methods by which this information may be presented to the commission were at first subjects of quandary.

Plan Adopted by the Commission

If complete testimony were taken regarding valuations and operating expenses and the commission entered a finding as to the total annual revenues to be allowed and then reopened the case for the purpose of taking testimony as to the character of rates best suited, the case would be unduly prolonged. If a finding were entered as to the revenues and a determination of the rates left with a utility, one of the principal sources of controversy would still remain. After careful consideration of this entire matter the commission determined upon the plan of instructing its engineering staff to present in the record a schedule of rates which should give a revenue of an amount which might be indicated or assumed by the engineers. This necessitates that the enginering staff shall assume a valuation of the property, shall assume a rate of return, shall assume an amount of operating expense, and based upon these assumptions compute an amount of annual revenue and develop a schedule of rates which will meet it. This results in bringing into the record a specific character of rate schedule for discussion. It possesses the disadvantage from the witness's standpoint of compelling a number of assumptions which are somewhat without the range of his jurisdiction, and in a sense results in putting his testimony up for the sole purpose of being shot at. It has, however, proved successful for the purpose for which it was intended, namely, the securing of expressions of opinion by all concerned as to the best rate to meet a given case.

*Excerpt from a paper presented before the Western Society of Engineers and the Chicago Section, A. I. E. E.

The second phase of the subject in which the commission is interested—namely, the numerical determination of a specific rate which will give a certain definite revenue—necessitates the introduction of consumer data to which a given rate schedule may be applied. These data are taken from the books of the utility by the accountants of the commission, who arrange and tabulate them in such form that they are applicable for the purposes intended. The working out of these forms and tabulations presented a pioneer field, and in handling the problem the engineer and accounting staffs of the commission collaborated, with the result that a form was developed, as shown in Table I, which is taken from an actual record placed before the commission in a rate-making proceeding. The data must be tabulated in such a manner that any form of rates may be applied thereto. The commission, in working out its schedule of rates, has relied upon its engineers for a computation of revenue which a given rate will develop. A superficial consideration will indicate the impracticability of applying a given rate to a total year's bills by multiplying each bill separately, and it was therefore necessary to develop a system whereby a revenue could be rapidly computed and changes contemplated in a schedule could be readily adopted without an entire recomputation (Table II). A table of this form is applicable only to a block or step schedule of rates. If rates of the Wright demand form are contemplated, the information must be worked up in the form shown by Table III. Having obtained information in these forms, it will be seen that a given rate may be applied in a very few minutes, with the result that the commission is at liberty to alter certain phases of the rate as frequently as desired, without entailing a large amount of work in the computations of changes of revenues which are involved. In a particular case that I have in mind fully sixty rates were worked up and applied before a final schedule was determined, and the amount of time involved was not a serious consideration.

Allocating Operating Expenses and Fixed Charges

The revenues thus derived are, of course, revenues for a specific year's consumption, and if the commission determines that it wishes to take into consideration certain increases or decreases in consumption, these can be readily cared for by obvious methods. In this discussion of forms of rates I have not taken up the matter of allocation of property values and operating expense to the different classes of service rendered. Such different classes of service frequently comprise residence service, business lighting service, flat-rate lighting service, direct-current power service, alternating-current power service and municipal street-lighting service. These classes of service are very frequently met, and in addition there are, of course, the

almost limitless possibilities of limited-hour service and seasonal service which may arise. The proper allocation of operating expense and fixed-charge items is a large problem and requires further analysis of operating characteristics. In a solution of this problem the engineers of the Illinois commission, in handling electric rate cases, have usually presented load curves of

TABLE I—RESIDENCE CONSUMERS—CONNECTED LOAD AND MONTHLY CONSUMPTION

Year Ended Dec. 31, 1915

(Connected load, 400 watts; average actual connected load, 318 watts)

Consumption, Kw.-Hr.	Number of Consumers												Total	
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Consumer-Months	Kw.-Hr.
0	1	1	4	6	7	5	11	10	11	8	8	10	82	....
1	..	..	..	..	2	4	3	5	3	2	..	2	21	21
2	..	..	1	4	3	6	11	7	3	1	..	..	36	72
3	1	2	7	9	8	10	11	7	3	8	4	3	73	219
4	3	6	11	11	14	11	5	12	11	6	5	3	98	392
5	6	4	3	8	7	7	9	10	8	8	8	7	85	425
6	6	8	5	4	2	5	7	5	9	12	8	4	75	450
7	6	4	6	4	5	4	10	7	8	2	6	4	66	462
8	2	6	6	7	10	9	2	2	3	7	8	8	70	560
9	5	5	9	6	4	4	6	5	4	7	7	1	63	567
10	4	7	8	4	4	7	9	5	6	7	5	5	71	710
11	5	1	1	6	3	4	2	7	5	4	5	10	53	583
12	2	6	4	3	8	2	2	3	4	6	3	9	52	624
13	3	5	2	4	5	2	2	5	4	3	5	2	42	546
14	2	1	10	5	3	5	2	..	6	8	7	8	57	798
15	4	3	1	..	3	5	3	2	4	2	10	3	40	600
16	6	10	1	4	2	3	2	5	1	5	9	7	55	880
17	2	2	5	2	4	2	3	2	2	2	2	5	33	561
18	2	2	5	4	2	2	2	2	3	3	4	1	32	576
19	2	1	..	..	3	2	..	..	1	1	5	7	22	418
20	5	3	1	3	1	..	..	2	3	2	2	4	26	520
21	4	3	2	1	2	..	3	2	1	1	4	3	26	546
22	2	2	2	3	..	3	..	2	2	3	1	..	20	440
23	3	..	..	2	..	1	1	..	..	3	..	5	15	345
24	..	7	1	4	..	1	..	..	2	2	1	1	19	456
25	2	1	1	..	2	1	1	..	1	1	..	2	12	300
26	3	6	2	..	1	..	..	..	1	..	2	2	17	442
27	..	..	..	..	..	..	..	..	..	2	2	1	5	135
28	1	1	..	..	1	..	..	..	1	..	3	2	9	252
29	1	..	1	..	2	..	1	1	..	..	..	3	9	261
30	1	..	..	..	..	1	..	1	2	..	2	1	8	240
31	..	..	1	1	..	..	..	..	..	2	..	2	6	186
32	1	..	2	..	..	2	..	1	1	..	..	..	7	224
33	..	..	1	..	..	..	..	..	..	..	..	1	2	66
34	1	1	..	..	..	..	2	..	..	1	..	1	7	238
35	..	..	..	..	1	..	..	..	..	1	..	..	2	70
36	..	..	..	..	..	..	..	1	..	1	..	2	4	144
37	1	..	..	1	..	1	1	..	..	..	..	..	4	148
38	1	..	..	..	..	..	..	..	1	..	1	1	4	152
39	1	..	..	1	..	..	..	..	..	..	..	..	2	78
40	..	..	..	..	..	1	..	..	..	..	..	..	1	40
41	1	..	..	..	..	..	..	..	..	..	..	..	1	41
43	..	..	..	..	1	..	..	..	..	..	1	..	2	86
44	..	..	..	..	..	..	..	..	..	1	..	..	1	44
45	..	..	..	..	..	..	..	..	..	..	1	..	2	90
46	..	..	..	..	..	..	..	..	..	..	..	1	1	46
49	1	..	..	..	..	..	..	..	..	..	..	..	1	49
50	..	..	..	..	..	..	..	..	..	1	..	..	1	50
53	..	..	..	..	..	..	..	..	..	..	..	1	1	53
54	1	..	1	..	..	..	..	..	..	..	..	..	2	108
58	..	..	..	..	..	..	..	..	..	..	1	1	2	116
64	..	..	..	..	..	..	..	..	..	..	..	1	1	64
70	..	..	..	1	..	..	..	..	..	..	..	..	1	70
Total consumers	92	99	104	108	110	110	110	111	115	123	131	134	1347	..
Total consumption	1470	1368	1212	1181	1102	1065	875	939	1165	1435	1726	2026	....	15,564

the electric system obtained from station log sheets of the utility.

The methods made use of for this allocation might well form the subject of a long discussion. In addition to the allocation of the various classes of electric service, in the case of a jointly operated property there usually arises the matter of the allocation of property and expense to a water property or a street railway or heating property.

I have discussed in the foregoing the issues which usually arise and may be expected to arise in every rate investigation. In many cases other issues entirely dissimilar will arise. In a recent instance a property was under investigation, and the usual study of values and operating expenses was conducted. In making some further investigation of general conditions it was discovered that the consumptions per consumer were materially less that those which had been found in other instances, and we came to the conclusion that the consumers' meters were registering in error. An examination developed that these meters, which were of the direct-current commutator type, had been in service for many years without inspection or adjustment. Mat-

TABLE II—TABLE SHOWING THE CONSUMER-MONTHS AND KILOWATT-HOUR CONSUMPTION OF BUSINESS CONSUMERS

Kilowatt-hour Monthly Consumption per Consumer	Consumer-Months	Total Kilowatt-hours
0-5	1,828	4,296
6	252	1,512
7	302	2,114
8	276	2,208
9	318	2,862
10	287	2,870
11-20	2,025	30,297
21-30	1,179	30,096
31-50	1,369	53,972
50-100	1,623	116,381
101-200	1,261	179,558
201 and over	1,225	634,060
Total	11,945	1,060,226

ters of this nature are certainly of vital importance in a rate consideration, and it behooves the engineer conducting an investigation to be thoroughly alive to unexpected possibilities of every nature. Studies of distribution efficiencies will often disclose defects in equipment of which the utility is not aware.

Investigation Discloses Faulty Meter

In another recent investigation our examination disclosed distribution efficiency of approximately 85 per cent in a community of about 1200 population. This excited our suspcion, and we made a test of the meter under which the utility procured its energy over a

TABLE III—TABLE SHOWING THE CONSUMER-MONTHS AND KILOWATT-HOUR CONSUMPTION OF BUSINESS CONSUMERS

Hours' Use of Maximum Demand	Consumer-Months	Total Kilowatt-hours
First 30 hours' use	4,074	42,210
Next 30 hours' use	2,627	82,954
Excess over 60 hours	5,244	935,062
Total	11,945	1,060,226

transmission line. This test disclosed that the meter was in error. Clearly a matter of this sort should be corrected before the rates are fixed for electric service. I mention these points as indicating the very wide scope of action and investigation which in justice should be conducted in connection with proceedings for the determination of rates.

In the course of the commission's work, which has covered several years, we early saw the need of collecting data from every source available, even though its application to the case immediately in hand was of

doubtful import. Such data collected with care and copious notes as to the conditions which prevail oftentimes prove invaluable in their application to other cases where the need is more apparent but where the facilities for securing the data are lacking. Thus in securing consumer data we have endeavored to analyze them so that they would be available to compare with other conditions which might be encountered. Data regarding connected loads, monthly consumptions, load factors, etc., are invaluable for certain purposes and difficult to obtain if original sources must be consulted. We have a complete installation of Hollerith tabulating and sorting equipment with which to handle this information. This has immeasurably facilitated the tabulations necessary, besides broadening the possible scope of the inquiries. Data shown in Tables IV and V were prepared for two cities from the results obtained by these methods in a form which I believe may be of interest and service, although not in the form most adaptable for our use. Comparisons of this nature are of interest in themselves and invaluable as a means of suggestion for discovering conditions which would otherwise not be unearthed. They have also frequently proved of value as a basis for estimate in cases where data as to consumptions were not available.

TABLE IV—STATEMENT SHOWING COMPARATIVE CONNECTED LOADS AND CONSUMPTION FOR VARIOUS CLASSES OF ELECTRIC CONSUMERS IN A CITY OF 10,000 POPULATION

Kind of Business	Average Active Consumers	Average Connected Load, Watts	Average Consumption in Kilowatt-hours												Average Kw.-hr. per Year per Consumer
			Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Residences*	365	749	25	22	17	15	12	10	9	10	11	18	22	23	194
Saloons and poolrooms*	23	1128	135	125	92	95	88	112	106	117	92	111	117	130	1318
Restaurants	5	437	130	126	92	111	100	159	155	134	126	124	129	131	1516
Stores	80	1397	117	81	65	70	60	60	58	78	76	97	111	126	999
Dentists	6	342	11	13	10	4	3	6	8	7	6	8	12	11	97
Livery barns and feed stables	8	513	58	51	33	28	21	18	15	24	27	36	43	51	406
Picture shows	4	4641	568	601	573	563	607	632	520	555	553	551	1002	612	7335
Photograph galleries	3	1262	29	32	28	27	22	20	29	16	15	22	41	68	348
Lodge rooms and halls	12	1163	30	39	31	39	37	28	21	24	23	31	27	31	362
Printeries	4	1520	143	186	135	111	115	110	84	101	119	157	163	151	1574
Hotels and rooming houses	6	1692	259	243	162	158	160	155	112	125	144	176	195	227	2117
Hotels and saloons combined	4	3019	381	332	265	306	263	300	230	287	313	352	362	409	3801
Offices and banks	40	766	49	41	30	32	27	26	27	32	25	29	37	47	402
Schools	3	1663	23	48	22	12	17	19	2	1	4	16	20	36	219
Churches	13	3810	54	46	36	54	37	20	15	12	26	33	37	46	413
Club rooms, halls and skating rinks	2	643	21	16	17	9	6	5	5	7	5	26	44	41	201
Blacksmith, machine shops and garages	11	1056	43	17	8	18	22	29	61	41	43	48	53	36	419
Factories	2	2150	180	149	104	90	59	41	31	36	35	35	57	87	901
Plumbers	1	150	5	4	1	1	2	3	14	22	2	3	3	4	64
Miscellaneous†	26	787	80	68	49	52	41	43	42	47	55	60	70	75	681
Average kw.-hr. per month of all consumers	620	1099	57	48	37	38	33	33	32	36	37	44	53	55	503
Average all, excluding those marked thus*	231	1227	99	82	64	68	68	62	60	68	64	80	96	98	908
Average kw.-hr. per month of all business consumers	255	1330	102	86	62	71	64	66	63	73	71	83	98	102	939
County jail	1	.....	481	555	475	198	319	277	247	280	432	410	501	447	4622
Public library	1	.....	538	452	227	525	358	122	14	34	247	383	644	541	4085
City hall and fire department	1	.....	583	569	539	429	375	306	207	447	368	485	594	687	5509

†Includes bakeries, greenhouses, tailor shops, post office, barber shops, railroad depots, laundries, gymnasiums and hallway lights.

TABLE V—STATEMENT SHOWING COMPARATIVE CONNECTED LOADS AND CONSUMPTIONS FOR VARIOUS CLASSES OF ELECTRIC CONSUMERS IN A CITY OF 25,000 POPULATION

Kind of Business	Average Active Consumers	Average Connected Load, Watts	Average Consumption in Kilowatt-hours												Average Kw.-hr. per Year per Consumer
			Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Residences	444	757	21	17	15	15	12	10	10	11	14	18	22	23	187
Saloons	74	897	94	82	75	73	58	63	92	99	99	82	80	101	998
Club rooms	22	2407	98	80	71	79	71	49	51	47	46	73	104	111	888
Barber shops	14	399	28	24	19	19	15	15	20	22	23	22	26	31	262
Livery barns and feed stables	6	716	60	56	42	36	28	22	22	27	30	38	56	63	478
Churches	10	1875	31	23	22	23	19	17	11	9	14	22	26	30	247
Tobacco stores	7	472	45	42	33	32	23	18	18	18	21	30	39	47	365
Schools	13	2425	55	63	45	56	32	27	14	18	21	29	61	43	464
Lunch rooms	3	530	53	43	34	37	31	33	40	40	40	44	49	62	506
Telephone offices	2	2315	285	251	219	230	203	174	279	209	233	232	303	302	2980
Confectioneries	9	809	80	64	55	65	63	76	97	101	106	85	87	86	965
Garage and automobile dealers	5	1062	90	71	61	91	75	72	82	81	99	80	92	94	987
Hospitals	2	8455	220	196	158	183	64	100	102	110	136	184	316	252	2121
Drug stores	9	1138	112	94	82	87	61	52	59	62	68	86	107	124	994
Miscellaneous retail business	221	1660	96	76	61	63	46	41	46	47	56	66	93	115	806
Hotels	2	2317	182	187	157	143	118	110	111	111	125	171	216	208	1839
Average kw., all business	399	.....	91	75	62	65	49	43	55	57	63	68	87	104	818
Average kw., less saloons	325	.....	90	74	59	63	47	41	46	47	55	65	89	105	780
Average kw., all	843	.....	54	45	37	38	29	27	31	33	37	42	53	61	487

Safety First—Buy Liberty Bonds

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COAL-HANDLING METHODS IN SUBURBAN RESERVE YARD

Various Kinds of Electrical Apparatus Are Installed to Handle Coal at Minimum Cost and Greatest Efficiency

The United Electric Light Company of Springfield, Mass., maintains a reserve coal supply in a field recently equipped for this service at Indian Orchard, about 6 miles (9.7 km.) from its principal generating station. The storage capacity is about 50,000 tons, but as shown in the accompanying illustration, taken recently, the supply of coal has been heavily reduced by the stress of winter weather and the shortage of fuel common to the entire East. Coal is brought to the reserve field by rail, and the trackage facilities include

HOW RAILROAD AND COAL-GATHERING TRACKS ARE RELATED TO COAL PILES

a siding 320 ft. (97.5 m.) long for temporary car storage, a discharge and loading track about 406 ft. (123.7 m.) long running through the storage area from east to west, and a 405-ft. (123.4-m.) section of standard-gage track without connection to the remaining rails, upon which is operated an electric locomotive crane.

The tracks are in general supported on reinforced concrete walls or a trestle. The trestle was designed for Cooper's E-60 loading, corresponding to heavy main-line service. The crane, which was built by the Industrial Iron Works, Bay City, Mich., has a rating of 6100 lb. (2766.9 kg.) at a radius of 45 ft. (13.7 m.). It is operated by a 75-hp. Westinghouse three-wire, two phase, 440-volt induction motor of the variable-speed type. Resistors for this service are mounted in the cab and are wired in conduit to Cutler-Hammer control equipment of the solenoid type mounted on a switchboard in one corner. Crouse-Hinds condulets are used, and the wiring is unusually rugged and well laid out for the service. The motor-control cylinder can be rotated mechanically by levers and either of two handles at the right and left sides of the operator's stand.

Energy is supplied to the field from the company's Indian Orchard generating plant and substation, close by. The locomotive receives energy through a jumper cable plugged into any of seven jack boxes mounted on a guard pipe-rail run along the side of the trestle track. These boxes are also of Crouse-Hinds design, and each is fused by a 100-amp. fuse block set carried in a box designed by the Chicago Fuse Manufacturing Company. No loose wiring is employed, barring the flexible cable feeding the locomotive from the jack box. The jack boxes are held in place against the guard railing by 2-in. by 5/16-in. (5-cm. by 0.8-cm.) iron straps, and the rail is of 1.5-in. (3.8-cm.) pipe throughout.

Except under the most extreme conditions coal is transported to the city station of the United company by railroad cars loaded from the reserve pile by the locomotive crane, but last winter it was necessary for a time to haul this fuel by gasoline motor trucks. The crane is operated by an employee of the company ordinarily at the State Street station in Springfield, the Indian Orchard plant being a hydroelectric generating station only. The yard and its fixed facilities were designed by McClintock & Craig, engineers, of Springfield, Mass.

Trust the President—Buy Bonds

DETERMINING THE SIZE OF WATT-HOUR METER

Considerations That Should Be Taken Account of in Connection with Customers' Installations to Further Economy and Accuracy

According to a discussion on meters at the recent convention of the Minnesota Electrical Association, there is a very decided tendency toward the installation of meters of smaller sizes. Where there is any question about the size of meter to install some central-station companies are using small-size meters, leaving it to the new-business department to obtain as large a load as it can. This practice has led to practically no trouble. In Minneapolis 95 per cent of the meters installed are of the 5-amp. type. Even for electric ranges, meters of the 15-amp. variety are used there. It is never desirable to install a meter of higher rating than is necessary to register the load efficiently and economically. Putting in too large a meter not only increases the investment in meters but also results in a large loss of revenue owing to light-load inaccuracy.

In general, when installing a meter the class of service must be considered. What applies to a customer does not necessarily apply to another. For example, in churches, stores, lodge halls, saloons, etc., the total connected load is nearly always used and a meter rated at 80 per cent of that load should be installed. For electric signs and like loads meters rated for the total connected load should be installed. In residences only

a few lamps are used at one time, as a general rule, and they are usually not of large size. Occasionally during some special functions the total connected load will be used. At such times a small meter would have to carry considerable overload. However, most of the modern meters will carry 200 to 300 per cent overload without danger of damage to the meter and will carry 400 per cent for a few minutes. The meter will operate slow on overload owing to the fact that the series-coil laminations are oversaturated. However, the infrequent loss resulting from overload will be compensated for by the increased activity of the meter on small loads of one or two lamps. Hence it is always advisable to install a meter having a rating equal to 25 per cent to 50 per cent of the total load in a residence.

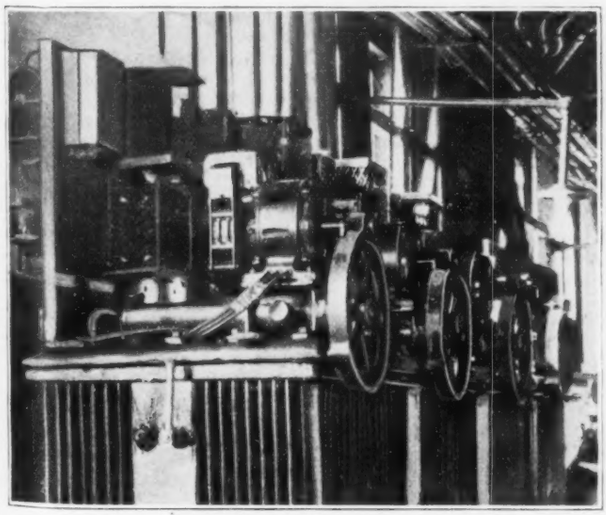
The same rule also applies to power customers having many small motors or one large motor. It is always advisable to install a meter with 60 per cent to 75 per cent of the rating of small individual drives and 75 per cent to 100 per cent for a large single motor. Experience has proved that this is the best practice except with motors operating elevators and cranes which are started and stopped frequently. These motors draw large starting current, so the best practice is to use a meter with 100 per cent to 125 per cent of the rating of the connected load.

Save Liberty for the World

CONVENIENT MOUNTING FOR REGULATOR ACCESSORIES

Current Transformers and Other Appurtenances Supported on Panels Which Are Attached to Regulators

Instead of mounting the current transformers and other appurtenances used in conjunction with voltage regulators in the usual manner, one of the Southern companies has employed the arrangement shown here-



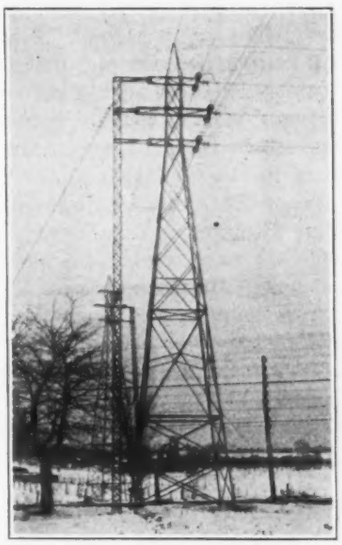
PANELS ATTACHED TO REGULATOR CASES

with. The accessories are mounted on panels attached to the top of the regulators principally because there was no room for panels in front of or at the side of the regulators. However, this arrangement has most of the advantages of the usual method and besides saves some wiring.

BRACING LINE TOWER

Ordinary Straight-Away Tower Reinforced to Avoid Buying Angle Tower

By means of attaching a latticed structure to an ordinary straight-away line tower and then guying it at right angles to the line a company in New England was able to use a standard tower where an angle tower would ordinarily have been required. By so doing it avoided buying a special tower which would have been more expensive than the structure used. As will be seen, a branch line is attached to the tower at right angles to the through line at this point. This arrangement has proved perfectly satisfactory from a structural point of view, and in these days of compulsory economy it has, as will readily be seen, much to recommend it.



PREVAILING TREND IN GROUNDING PRACTICE

Discussion of Types of Ground Connections and Factors That Enter Into Establishing a Reliable Connection with the Ground

The characteristics of different types of ground connections and the field to which each type is fitted for use were discussed by W. C. Wagner, electrical engineer of the Bureau of Standards, in a paper presented before a recent meeting of the Western Association of Electrical Inspectors. He also explained why the weather conditions and soil surrounding the ground connections are important factors. The methods of grounding in common use are driven pipes, plates, strips, water pipes and patented devices.

The driven-pipe ground connection is economical and reasonably satisfactory for lightning protection grounds and low-voltage circuits when high-potential and low-potential conductors are not likely to cross and when the resistance is not required to be less than a few ohms. Driven pipes are easily inspected, readily removed and do not require large ground areas.

The latter advantage is important in places where the ground must be installed in restricted space or under pavements. Mr. Wagner said: "A greater depth of penetration than 10 ft. (3 m.) in conducting soil is not, in general, economically advisable. An earth connection to be efficient must be below the frost line, because a variation in resistivity of more than 200 per cent may be expected in reducing the temperature from 20 deg. C. to — 20 deg. C. Several driven pipes connected in parallel decrease the resistance of the ground connection when the pipes are separated from 1 ft. to 8 ft. (0.3 m. to 1.8 m.). A pipe ground should not be made near a pole because the pole exerts a shielding

effect and shuts off a large part of the current flow. Mechanical considerations will usually govern the choice of size of driven pipe, but it has been found that the best results can be obtained with pipe from 0.75 in. (19.1 mm.) to 2 in. (5.08 cm.) in diameter."

Buried plates are not used to any extent because the driven pipe grounds are more convenient and give the same results in most cases. The area of a single plate in ordinary conducting soil cannot be economically increased beyond 20 sq. ft. (1.8 sq. m.) and should not be buried deeper than 8 ft. (2.4 m.). It is usually better to bury two smaller plates some distance apart and connect them by a wire than to bury a larger plate of the same ground resistance. The surrounding soil greatly affects the use of buried plates, and an increase of conduction can be obtained by surrounding the electrode with salt or a bed of coke. Moisture changes do not affect a coke bed, because the coke bed constitutes virtually an extension of the electrode. Coke has the disadvantage as compared with salt of requiring excavation, as the latter can be carried into the ground by moisture from a pocket at the surface. Coke also exerts a corrosive action where iron is used and is generally considered more detrimental than salt. Copper electrodes should be used where long life and minimum attention is desired. Strips should be used where bedrock is near the surface of the ground and it is impracticable to embed pipes or plates deep enough to provide an effective earth connection. This is especially true in soil of high resistivity because of the electrostatic capacity in the case of a strip is greatest for a given amount of metal. This method is also applicable, therefore, for use in high-resistance soil where driven pipes would be used.

Water pipes give less resistance to ground than any other of the methods discussed. "A water pipe in an average soil," Mr. Wagner said, "has approximately the resistance of from fifty to sixty driven pipes or buried plates in parallel. Pipe systems are easily accessible at the service entrance. Moreover, the areas covered by electric lighting systems are approximately the same as those covered by water mains. This method of grounding is therefore advantageous and in the case of low-voltage alternating-current circuits does not appreciably affect the water-piping systems."

In the discussion patented devices were grouped under one head and were not reviewed as to their reliability.

Safety First—Buy Liberty Bonds

ACTUAL CONSTRUCTION COST OF MEDIUM-SIZE STATION

Data Refer to a 4500-Kw. Plant—The Advance in Prices Since 1916 Is Not Shown by the Figures Reproduced

In the following table is given the itemized cost of construction of a Massachusetts central station situated on tidewater and including a building designed for one 500-kw. and two 2000-kw. turbo-alternators. Construction was begun in April, 1916, and the cost of the plant, including land and preliminary engineering, built to a capacity of 2500 kw. installed machinery (one 500-kw. and one 2000-kw. unit), and covering a building, boiler, coal-handling and piping installation adequate for 4500 kw., approximates $269,000. It is expected that the second 2000-kw. unit will add about $40,000 to the station cost, making the probable complete cost of the 4500-kw. installation about $309,000.

ITEMIZED COST OF PLANT BUILT TO 2500-KW. RATING
(Building, boilers, piping, etc., provided for 4500 kw.)

LAND		
Land	$25,000	
Docks, walls and filling	4,271	
Legal expenses for do	348	
Surveying for do	43	
Dredging and intake	3,035	
		$32,697
Preliminary engineering investigation		7,000
BUILDING		
Sub-surface foundations	$9,404	
Steel for station building	18,080	
Superstructure	27,641	
Stack, 200 ft. high, 9 in. inside diameter	6,954	
Steam heating	772	
		62,851
SERVICE EQUIPMENT		
Coal and ash handling	$11,594	
Coal and ash bunkers	3,063	
Water supply and storage	353	
Oil filters and storage	48	
Crane	1,588	
		16,646
BOILER PLANT		
Four 342-hp. B. & W. boilers with superheaters and settings	$24,074	
Four Taylor underfeed stokers and drive	8,664	
Flues and air ducts	459	
Pumps—turbine-driven duplicate set	2,597	
Blowers—turbine-driven duplicate set	1,674	
Feed-water heater (1500 b.-hp.)	866	
Instruments and regulators	1,092	
		39,426
PIPING FOR 4500-KW. RATING		
High-pressure steam piping, steel valves and fittings	$4,222	
Exhaust steam piping, valves, fittings, etc.	2,278	
Water and oil piping	1,304	
Condenser piping, outside building	9,337	
		17,141
TURBO-GENERATOR PLANT, 2000-KW. UNIT (500-kw. unit from old station, see later section)		
Turbo-generator, 2000-kw. rating, 80 per cent power factor	$22,904	
Surface condenser, 3500 sq. ft.	9,054	
Condenser piping, inside	1,423	
Air supply and cleaning	935	
		34,315
SWITCHBOARD AND ELECTRICAL EQUIPMENT		
Switchboard, oil switches, instruments, etc.	$12,567	
Exciter and 100-kva. auxiliary three-phase transformer	2,393	
Municipal station apparatus	21	
Station wiring	1,075	
Connections to overhead lines	5,400	
		21,456
MISCELLANEOUS		
Interest during construction	$3,706	
Fire insurance	680	
Liability insurance	162	
Steam coal used during building and in tests	1,031	
Miscellaneous material, apparatus, tools, hardware, etc.	1,569	
Unclassified labor, watchmen, foremen, etc.	1,817	
General expenses, unclassified	410	
		9,375
ENGINEERING		
Engineering architect	$6,300	
Field supervision	2,860	
Drafting and blueprinting	1,858	
Drafting and office expense	259	
		11,277
500-KW. TURBINE TRANSFERRED FROM FORMER STATION		
Turbo-alternator, 500-kw.	$10,000	
Piping for turbine	2,752	
Wheeler condenser (second-hand)	1,000	
Air and circulating pump	1,435	
20-hp. Terry steam turbine	425	
25-kw. direct-current motor-generator exciter set	1,220	
Instruments	85	
		16,917
Total		$269,101

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

PUBLIC POLICY MESSAGES ON CUSTOMERS' STATEMENTS

Oregon Property Takes Up Each Month a Different Phase of the Relations Existing Between Utility and Public

The North Coast Power Company, Hillsboro, Ore., has inaugurated the policy of submitting to its customers with each monthly statement a public policy "story" in which a definite phase of the relation existing between the utility and the public is analyzed.

Prompt Payments

All bills by the North Coast Power Company, due and payable the first of each month, are for services rendered the preceding month. Bills not paid by the 10th of the month become delinquent and the service subject to discontinuation without further notice.

It is necessary, in fact, required by state law, that public service utilities adopt definite rules and regulations pertaining to their service, and to observe a uniform system of rates and methods of collection.

The above rule is as necessary to the efficient and economic operation of the North Coast Power Company properties as is the continuous and reliable service given. It is as necessary as the personal service and industry of its employees. The accurate accounting and keeping of the many individual records require its enforcement.

Time wasted in carrying delinquent accounts and lost in enforcing their collection would otherwise be devoted to improve the service, to decrease the operating expense, and ultimately to reduce the cost of service to the consumers. Kindly keep these facts in mind and make remittances promptly.

War Savings Stamps

21,000,000,000 dollars!

This amount Congress appropriated the past year to carry out the great war of Democracy and Humanity.

From the birth of our country's freedom in 1776 to 1917, 141 years, the cost of operating its government has been 26,000,000,000 dollars. This sum includes all wars in that period.

Now, in less than a year, this World War of Freedom has caused our government to raise a sum almost as great as that which maintained our country's freedom nearly a century and a half.

2,000,000,000 dollars of this amount is to be in small sums, chiefly twenty-five-cent pieces. The annual saving of each American citizen is but $50. It is evident that a great number have been unable to subscribe to Liberty Loan issues. To offer these people a chance to do their bit the government is issuing War Savings Stamps. 100,000,000 people in the United States to raise 2,000,000,000 dollars means $20 per person—means 4 War Savings Stamps or 80 Thrift Stamps to each man, woman or child.

Don't fall below the average!

Sacrifice something!

Save something!

Be loyal, unselfish!

Help win the war!

The North Coast Power Company sells War Savings Stamps.

PUBLIC POLICY SERIES NO. 1 — NORTH COAST POWER CO.

A Tri-Cornered Proposition

The public utility exists by reason of a need for the service for which it was created to render. This service is successfully and economically given only when the three prime factors entering therein, the investors, the operators and the public, each provides an adequate service at a fair return. No contract or agreement survives which does not provide a mutual aid and just transaction to all parties concerned.

The investors' need must provide sufficient funds to construct the skeleton around which the utility is to grow and to provide for its future extensions. Their return is a fair interest on the amount invested.

The operators provide the sinews by means of which the plant moves—becomes a growing concern. The employes, by reason of systematic methods, industry, loyalty and efficiency, produce reliable service at economic rates. Fair wages and humanitarian treatment attract and hold such employes.

The consumer provides the protoplasm by means of which the utility grows and prospers. A sick or impoverished horse plows a poor furrow. A constantly criticised employe fails to perform his duties properly. The public best serves itself by protecting the utility from unjust criticism and abuse and by eliminating unfair restrictions which tend to cramp the growth of the utility. Its fair return is reliable service at lowest possible rates which tend to upbuild the community, invite further investment of capital and maintain stable business conditions in general.

Office Hours 1156 Second St., Hillsboro 8 A. M. to 5:30 P. M. — Telephone Day, Main 922 Night, Main 921 — When remitting by check return this stub only.

JANUARY 1918 — JANUARY 1918

To NORTH COAST POWER CO. Dr.

PLEASE BRING THIS BILL WITH YOU

Arrears, previously billed and now delinquent		Arrears
LIGHT		
Meter Readings 1918		
Meter Readings 1918		
KW-H@ 12 cents		Light
KW-H@ cents		
POWER		
Meter Readings 1918		
Meter Readings 1918		
x :: KW-H@ cts		Power
x :: KW-H@ cts		
WATER		
Meter Readings 1918		
Meter Readings 1918		
Cu. Ft. Gallons		Water
Total		Total
Discount		Discount
Net		Net

Note: Unless bill is paid prior to the 10th of the month service may be discontinued without further notice.

USING THE CUSTOMERS' ACCOUNT STATEMENTS TO PROMOTE GOOD RELATIONS WITH THE COMPANY

Number one of the series was printed on the January, 1918, bill, which is reproduced. Numbers two and three, February and March, entitled "Prompt Payments" and "War Savings Stamps" respectively, are also shown.

Liberty Protects You—Buy Bonds

THE INCREASED COST OF LINE EXTENSIONS

Chicago Companies Point Out Comparative Cost of Construction Under Present Conditions and Under Conditions and Prices in 1914

In testimony before the State Public Utilities Commission of Illinois, A. S. B. Cushing, statistician of the Public Service Company of Northern Illinois, presented figures to show how the cost of constructing service extensions has increased since the beginning of the great war. The data which he presented apply to the company's system, which supplies approximately 170 villages, cities and communities. Its lines extend over a territory of approximately 5000 square miles (1,295,000 hectares) in which there is a population of about 500,000. This system is supplied from eighteen plants, of which only eight are of importance.

In regard to the study of the investment in a two-pole line extension Mr. Cushing said: "First, we have a certain amount of copper wire and two 35-ft. (10.6-m.) poles, the expense of shaving and painting the poles, labor for delivering and setting the poles, the usual cross-arms, insulators, braces and other hardware, and then the labor of putting up the braces, putting up the cross-arms and stringing the wire, the present total cost of such items being $77.40. To this amount we must add 10 per cent of the material cost for storeroom charges on the items which pass through our storeroom stock. This adds another $5.49. Then 5 per cent of the $77.40 must be added for drafting expense and general records. Another 5 per cent must be added for engineering and incidentals, which brings a total of $90.63.

"Now, in a great portion of the company's territory the various telephone companies join in the investment for poles, and I have used in my calculations 35-ft. poles, because 35-ft. poles are required when the telephone company joins in the investment. Therefore I have subtracted from the aforesaid $90.63 a half interest in the poles, and that half interest is figured at $9 per pole. I have thus subtracted $18, leaving the net cost for a two-pole extension $72.63. This is the cost of such an extension with present prices.

"To this amount must be added," continued the speaker, "the customer's share of transformer capacity. That for a residential customer in the Public Service Company of Northern Illinois would average at the present time approximately $5.25. There would also have to be provided a service drop that averages 189 ft. (57.6 m.) of No. 8 double-braided weatherproof copper wire at a present cost of $12.68. Also, the weighted average cost of an electric meter for a residential customer at present costs would amount to $8.51. All of such items would have to be added to the $72.63, making a total of $99.07. These items are all charged to the capital account."

For normal prices Mr. Cushing took the figures for the year 1914, as prices at that time did not seem to have been affected by war conditions. The cost of a two-pole extension in those normal times was $44.07 for a residential customer, as compared with $72.63, an increase of about 70 per cent. The cost of transformer capacity per customer in normal times was $3.55, as compared with the present cost of $5.25, or an increase of approximately 48 per cent for the present time. The cost of a service drop in normal times was $6.99, as compared with the present cost of $12.68, making the present cost an increase of 81 per cent over normal-time prices. The cost of an electric meter in normal times was $7.16, as compared with $8.61 for the present time, making the present cost about 19 per cent more than in normal times.

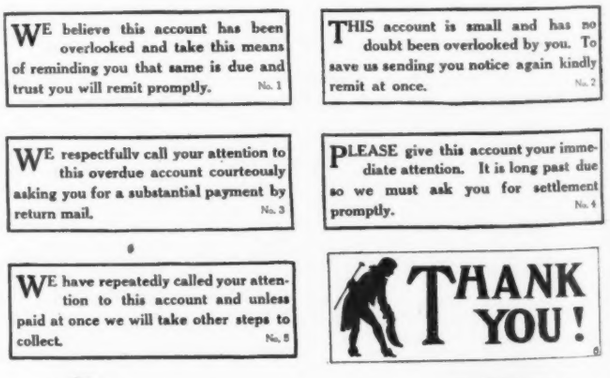
Mr. Cushing stated that the total cost of line extensions of his company during the year 1916 was $650,629.05. During that year the company issued approximately 5000 work orders for all line work, of which it was estimated 1500 were for two-pole line extensions. It was also brought out that about 92 per cent of the total two-pole extensions were for residences, the other 8 per cent being for commercial houses or factories.

Homer E. Niesz, assistant to the vice-president of the Commonwealth Edison Company, in the same case stated that the present cost of a two-pole line extension on the lines of the Commonwealth Edison Company is between $75 and $80, and that the cost of a two-pole line extension in 1914 was approximately $50. These were average costs.

MAKING USE OF STICKERS TO HELP WITH COLLECTIONS

A Series That Are Used by an Eastern Lighting Company and Have Produced Favorable Results Show Individuality

The accompanying series of stickers are used by the Kingston (N. Y.) Gas & Electric Company in connection with its collections and have had good results.


WE believe this account has been overlooked and take this means of reminding you that same is due and trust you will remit promptly. No. 1
THIS account is small and has no doubt been overlooked by you. To save us sending you notice again kindly remit at once. No. 2
WE respectfully call your attention to this overdue account courteously asking you for a substantial payment by return mail. No. 3
PLEASE give this account your immediate attention. It is long past due so we must ask you for settlement promptly. No. 4
WE have repeatedly called your attention to this account and unless paid at once we will take other steps to collect. No. 5
THANK YOU!

STICKERS USED BY NEW YORK STATE LIGHTING COMPANY

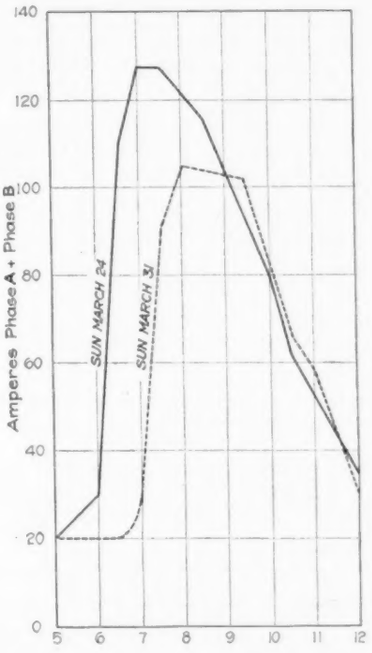
Such stickers lend individuality to the account. They are courteous yet firm.

The series is numbered, and different-colored papers help to distinguish the different numbers.

EFFECT OF DAYLIGHT SAVING

Load Curve of Residential Feeder Shows that Peak, Besides Being Shifted, Has Been Lessened

A decided shift in peak load accompanied by a reduction of the demand is shown in the accompanying curves taken on one of the residential lighting feeders of the Hartford (Conn.) Electric Light Company on the Sunday preceding the inauguration of daylight saving and the first day under the new program. The evening peak on March 24 occurred about 7 o'clock, while that of Easter Sunday was at 8 p. m., with a reduction of about 16 per cent. From 9 o'clock on the loads on the two days were almost coincident. On the morning of each day the conditions were reversed, the peak load (not shown on the diagram) reaching 30



HOW DAYLIGHT SAVING AFFECTS RESIDENTIAL LIGHTING

amp. on two phases of the circuit on the 31st, compared with a morning peak of 21 amp. on the 24th. The reduction in the evening peak following the institution of daylight saving is significant in view of the importance of keeping the investment down for this class of business.

Halt the Hun—Buy Liberty Bonds

NINETY PER CENT COLLECTIONS BY TWENTIETH OF EACH MONTH

Indiana Company with 1 Cent per Kilowatt-hour Discount Delivers Card Bill and Mails but One Delinquent Notice

Since the increase in postage the Indiana Railway & Light Company has been delivering the monthly bills to its 6000 creditors in Kokomo on the first of the month by meter readers at a cost of approximately $35 per month, or, roughly, half a cent per bill. Bills are in card form, as illustrated, the cards measuring 3¼ in. by 5½ in. (8.25 cm. by 14 cm.). The back of the card is used for timely advertisements. A discount of 1 cent per kilowatt-hour is allowed for payment before the tenth, and it is noticed that approximately 80 per cent of accounts take advantage of this. On the twen-

INDIANA RAILWAYS & LIGHT CO.
LIGHT AND POWER DEPARTMENT
Office Hours: 7:30 a. m. to 5 p. m.
Open Saturdays and 10th of Month until 8:00 p. m.
112 E. Sycamore St. **Nov. 30, 1917** Phones 331-355

Save Yourself Annoyance and Delay by bringing this Card. — Do It Electrically. Appliances on Easy Monthly Payments.

Present Readings _____
Last Readings _____
K.W. H. Consumed _____
@ _____ per K.W.H.$ _____
Less 1c per K.W.H. on ____ until 10th _____
Net Bill for November _____
Less Unread Meter Minimum _____
_____
Unpaid { Light / Appliance } Balance _____
Total Amount Due _____

All claims for adjustment must be made by the fifth. All bills payable on or before the tenth. Positively no discounts allowed after that date. We have no collectors. Failure to receive bill does not entitle the consumer to exception to this rule.

November 30, 1917

MONTHLY BILL FORM USED BY MIDDLE WEST COMPANY

tieth delinquency notices, as shown, are mailed. Only one such notice is sent out.

Collections are as follows: Eighty per cent by tenth

Form 215. 2m 12-17

INDIANA RAILWAYS AND LIGHT COMPANY
KOKOMO, INDIANA

Light and Power Department

No. _____
_____ 191
M _____

As the bill presented for electricity on _____ 191 , amounting to $_____ may have been lost in transit, mislaid or perhaps forgotten, we take the liberty of reminding you that the ten-day limit will expire _____ 191 , at 12 o'clock, noon, after which date service will be discontinued without further notice.

A charge of $1.00 is made for re-connecting.

Respectfully,
INDIANA RAILWAYS AND LIGHT CO.

Our consumers will save at least one month's lighting bill in the course of a year if they will take advantage of the discounts given by paying on or before the last day of the discount period.

DELINQUENCY NOTICE MAILED TO TARDY CUSTOMERS

of month following period energy was used; additional 10 per cent by twentieth of same month; additional 9 per cent by twentieth of following month—leaving approximately 1 per cent for disconnection delinquents.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Unique Three-Phase Transformer Connections.—The banking of transformers for different load conditions is discussed and illustrated.—*Power Plant Engineering*, April 1, 1918.

Materials and Their Arrangement in Transformer Construction.—Factors that influence the selection of conductors for primary and secondary windings, iron for the magnetic circuit and insulation for both of the foregoing are dealt with in the article.—London *Electricity*, March 22, 1918.

Notes on the Design of Electromagnetic Machines, Part II.—STANLEY PARKER SMITH.—A three-phase turbo-alternator is designed to give 2000 kw. at 3000 r.p.m. at a line pressure of 500 volts, and the mechanical stresses in the rotor are discussed.—London *Electrician*, March 15, 1918.

Lamps and Lighting

Recent Developments in Marine Lighting.—Illuminants, unattended lights and types of flashers, etc., are described.—London *Engineer*, March 8, 1918.

Survey of Methods of Directing and Concentrating Light.—LIEUT.-COMMANDER HAYDN T. HARRISON.—From two well-known laws the author concludes: (1) that with beams that are approximately parallel it can still be considered that the illumination is inversely proportional to the square of the distance from the source, provided that the illumination is measured at sufficient distance to eliminate any error due to the area of the secondary source or mirror; (2) that the luminous flux from a parabolic mirror, if focused so that there is little dispersion, is proportionate to the square of its area divided by the square of the area of the source. Included in the article is a table which gives the luminous value obtained by the concentration of light at angles of 270 deg., 180 deg. and 90 deg., being the equivalent of deep, medium and shallow reflectors. Such luminous value is calculated by dividing the solid angle of luminous flux by the solid angle of the beam produced.—London *Electrician*, March 8, 1918.

Generation, Transmission and Distribution

Control of Large Amounts of Power.—E. B. WEDMORE.—The increasing use of electrical energy and its economical production require the use of larger generating stations and the linking together of existing plants. These extensions involve something more than the use of larger units and the adding of unit to unit. The several factors that determine the new conditions are discussed in detail.—London *Electrical Review*, March 15, 1918.

Availability of Energy for Heat and Power.—JOHN BLIZZARD.—The article outlines the sources from which Canada receives supplies of energy and the extent to which each is utilized. In the course of a year Canada burns 30,000,000 tons of coal, of which 60 per cent comes from the United States, the remainder being mined in Canada. Six million tons are used for industrial power. Water power is used for the most part to supply mechanical and electrical energy. About 2,000,000 hp. has so far been developed. The total available horsepower is estimated at about 18,000,000 hp., of which 8,000,000 hp. is estimated to be available within the present range of markets. An additional development of 6,000,000 hp., assuming an efficiency of conversion of 60 per cent and a plant factor of 40 per cent, would supply about 1,500,000 hp. continuously. This is much more than sufficient to supplant that generated yearly by 16,000,000 tons of coal. Different types of central stations are then considered: (a) Those in which the fuel is completely gasified by partial combustion and the energy distributed either as gas or electrical power; (b) those in which the fuel is carbonized and energy distributed in the form of solid fuel and gas or electricity; (c) those in which the fuel is completely burned and electrical energy and steam distributed; (d) those in which fuel is completely burned and electrical energy only distributed.—Toronto *Electrical News*, March 15, 1918.

Cables and Ocean Beds.—The problems that have to be met and the methods of solving them in the laying of submarine cables are discussed.—*Telegraph and Telephone Age*, April 1, 1918.

Outdoor Switching Apparatus.—H. G. MACDONALD.—The increase in distance covered by electric power transmission lines and the corresponding increases in voltages to make such transmission lines practicable are discussed and reference made to outdoor equipment which is suitable for this service.—*Electric Journal*, April, 1918.

Hydroelectric Industry in Scandinavia and in the Dutch East Indies.—(Abstract from a lecture given by A. Groothoff before the Royal Institute of Engineers in Holland.) The useful water power of Norway is estimated at 7,000,000 hp., of which the state owns by purchase one-seventh and utilizes about 1,000,000 hp. Sweden has about 6,000,000 hp., of which the state owns one-sixth and utilizes about 1,000,000 hp. While Norway's water power is fairly divided over the entire country, Sweden's is concentrated in the bleak, sparsely inhabited northern portion. The generating station at Nove transmits 210,000 kw. over 125 km. at a pressure of 110,000 volts. The cost of the entire station and system was $3,000,000 and the cost of a kilowatt-year around $1.50. During 1916 approximately half of the energy supplied by the state works of Sweden was utilized by the electrochemical industry.

Traction

New Type of Power Transmission for Berlin Railways.—Instead of using overhead wires or "third-rails," the engineers are planning to run high-tension

wires near the "inside" rail. Instead of scrapping the entire car equipment, the management has decided to build only trucks and to attach the old cars to the new electric trucks.—Abstracted in *Schweizerische Bauzeitung*, March 2, 1918, from an article in *Zeitschrift der Verein d. E. V.*

Gearless Locomotive for the St. Paul.—A. H. ARMSTRONG.—The article deals with the extreme simplicity in design offered by mounting the armature directly upon the driving axle, thus eliminating all gears, quills, jack shafts, side rods, etc. The article gives detailed information in connection with the 3000-volt gearless locomotive now under construction in the General Electric shops for the Chicago, Milwaukee & St. Paul Railway's extension to Seattle.—*Electric Railway Journal*, March 23, 1918.

Installations, Systems and Appliances

Industrial Controllers.—H. D. JAMES.—This article, which is the sixteenth installment of a series, includes various illustrations showing methods of connecting motors and controllers for industrial applications.—*Electric Journal*, April, 1918.

Discussion by the Faraday Society on Electric Furnaces.—The distribution of the heat in electric furnaces is discussed.—London *Electrician*, March 15, 1918.

The First Electric Steel-Melting Furnace in South Africa.—W. BUCHANAN and GEORGE H. STANLEY.—The author deals rather exhaustively with the subject of the quasi-arc process and embodies information of value related especially to electric steel-melting furnaces.—*Transactions of the South African Institute of Electrical Engineers*, November, 1917.

Wires, Wiring and Conduits

High-Voltage Condenser for Radio Transmitters.—Description of a type of high-voltage condenser which is said to have sufficient dielectric strength under the strain of the impressed voltage of the average wireless transmitter to prevent break-down. Another important feature of the condenser is that it is equally applicable to high and low voltages and may be used in radio-frequency circuits of a wireless-telegraph transmitter or for measurements in an experimental laboratory.—*Wireless Age*, March, 1918.

Electrophysics and Magnetism

Direct-Current Corona.—SYLVAN J. CROOKER.—The influence of series sparks on direct-current corona is discussed and the results of experiments are recorded. It was observed that a spark gap in series with the discharge tube affects the positive and negative corona in very characteristic and striking ways. The changes are due to intermittent currents. A hot-lime-cathode Braun tube was developed and used in observing the weak pulsating currents which pass through the spark and the corona tube. Evidence was given to show the relation of the corona to the arc discharge. An attempt at an explanation of the pulsating current has been made.—*American Journal of Science*, April, 1918.

Electrochemistry and Batteries

Processes for the Manufacture of Aluminum.—Alumina (Al_2O_3) in a bath of molten cryolite is subjected to electrolysis and yields metallic aluminum and free oxygen which burns the carbon electrode to form carbon monoxide, the latter in turn yielding carbon dioxide. The supply of electrical energy which is used to effect electrolysis is also used to keep molten the salts, but since the consumption of energy necessary for the double purpose is excessive, the process can be used commercially only where very cheap energy is available. The chief phases of the complete manufacturing process are discussed.—London *Electrical Review*, March 8, 1918.

Units, Measurements and Instruments

Great Britain's Interest in the Metric System of Weights and Measures.—HARRY ALLCOCK.—The author compares the conditions in Germany and Great Britain with regard to the employment of the metric system, pointing out that the longer the adoption of this inevitable reform is referred the greater will be the magnitude and extent of the incidental difficulties to be overcome.—London *Electrical Review*, March 1, 1918.

Telegraphy, Telephony and Signals

Signaling and Interlocking of Keadby Railway and Bridge.—JAMES BENJAMIN BALL.—The article deals with interlocking and signaling as applied to the railway and bridge and also with certain safety and protective devices which were utilized.—London *Engineering*, March 1, 1918.

The Effects Produced Upon Audion Characteristic Curves by Various Kinds of Signals.—A. D. COLE.—The buzzer, electron relay and 60-cycle alternating current have been investigated to find out to what extent the magnitude of the plate and grid signals is influenced by the kind of excitation applied. It was found they produced different effects, which were embodied in curves involving plate current, grid current and grid signal. The experiments were conducted at the United States naval radio laboratory. The work is being continued at the Ohio State University.

Radio Inductive Interference.—LIEUT. ELLERY W. STONE.—The inductive interference from radio stations on telephone lines is discussed.—*Telephony*, March 30, 1918.

Miscellaneous

Nomenclature.—A. P. TROTTER.—A discussion of the electrotechnical terms in use in the English language as decided upon by the British national committee of the International Electrotechnical Commission is set forth.—London *Electrical Review*, March 22, 1918.

Engineering Evolution of Power Plant Apparatus, Section 27.—FRANCIS HODGKINSON.—Reviewing steam turbine development, this continued article deals with lubricating systems, exhaust passages, progress and future possibilities, etc. Performance curves are included.—*Electric Journal*, April, 1918.

Rusting of Boiler Tubes and Its Prevention.—BRUNO ZSCHOKKE.—The results of exhaustive tests indicate that there are five causes which produce rusting and corrosion of boiler tubes, viz., (1) acidity of feed water, (2) formation of detrimental quantities of free hydrochloric acid, (3) formation of fatty acids, (4) localized electrolysis effects, (5) chemical change due to the combination of water with the iron. Among the preventive means suggested are 0.05-0.10 per cent chrome-salt (bichromate-of-potassium) solutions, which show remarkable rust-preventing properties. Sodium bichromate would be just as effective and much cheaper for practical use.—*Schweizerische Bauzeitung*, March 2 and 9, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Investigations Under Way or Completed

(RESEARCH WORK REPORTED SINCE MARCH 16)*

AUDION CHARACTERISTICS.

Experiments are being conducted on the effect upon the audion of various kinds of signals, namely, buzzer, electron relay and 60-cycle alternating current. Three audions have been examined to find out how much the magnitude of the plate signal and of the grid signal depends upon the kind of excitation used. It was found that the magnitude of the effect, its law of change with variation of direct coltage on the grid, and even its sign, were different according to whether the signal emf. was produced by a buzzer, an oscillating audion or a 60-cycle alternating-current source.—*A. D. Cole, Ohio State University, Columbus, Ohio.*

CABLES, HEATING OF.

Experiments show that the maximum safe working internal temperature of an 11,000-volt cable is 150 deg. Fahr. By placing blowers in alternate manholes and forcing the hot air out of the ducts through the intervening manholes it was possible to reduce the duct temperature about 40 deg. Fahr. in one section containing heavily loaded cables.—*W. A. Keating and C. H. Mueller, Duquesne Light Company, Pittsburgh, Pa.*

Crude vaseline when used as a filler to replace the air in duct lines reduces the heating of a cable to a considerable degree, with the following advantages: (1) increased current-carrying capacity, (2) elimination of hot spots, (3) decreased electrolysis, and (4) mechanical protection. Dissipation of heat from cables now in service is limited by the high internal heat resistance in the cables themselves. Removal of heat by crude vaseline is practical commercially, as far as can be determined by laboratory test. It is recommended that the next step be a trial in some actual line duct.—*E. O. Schweitzer, Commonwealth Edison Company, Chicago.*

CABLES, VACUUM FORMATION.

Several breakdowns have occurred a few feet from splices, suggesting that a partial vacuum may have been formed there at low temperatures and that moisture was subsequently sucked into the insulation. A whistling sound has actually been reported by the workers after the removal of sealing caps in cold weather. Experiments have shown that if the pressure within a cable is atmospheric at say 90 deg. Fahr. an underpressure as high as 1.6 lb. per square inch (112.5 gm. per sq. cm.) may be developed at 32 deg. Fahr. Research is therefore desired to develop a method of splicing at a low temperature to prevent this suction of moist air when the cap is removed.—*William A. Keating, Duquesne Light Company, Pittsburgh, Pa.*

CONDENSERS, PRE-CHARGED.

A theoretical investigation of the properties of electrostatic condensers in series and in parallel, the condensers assumed to be pre-charged to different voltages before being connected into circuit. The theory as developed explains and generalizes the performance of the so-called Delon apparatus recently proposed in Europe for testing cables with high-tension direct current.—*V. Karapetoff, Cornell University, Ithaca, N. Y.*

CORE LOSSES IN MOTORS.

Iron losses in single-phase and polyphase motors have been studied. A two-phase motor having two complete single-phase pyramidal windings was tested and the losses carefully analyzed when operated on both two-phase and single-phase. The flux densities were the same for single-phase and for two-phase operation. The results show that the total iron losses were also substantially the same in both cases. There is a theory regarding single-phase motors according to which the motor has a double-frequency current in the armature when it is running at synchronous speed. This might lead one to think that there should be iron losses in the rotor of the single-phase motor when operating at or near synchronous speed. The above results, however, show conclusively that there are practically no iron losses in the rotor of a single-phase motor near synchronous speed.—*J. L. Hamilton, St. Louis, Mo.* [The writer probably has in mind the resolution of the pulsating magnetic field into two revolving fields of opposite rotation. The flux which glides against the rotor is wiped out by the secondary currents, and this probably accounts for the absence of iron loss in the rotor at synchronism.—*Editor's Note.*]

HIGH-VOLTAGE MEASUREMENTS.

Corona voltmeter constants are being determined from the measurement of the voltage in the high-tension circuit. A method has been devised which involves the use of a large air condenser of accurate construction and also of a kenotron rectifying tube, so that the values of alternating voltage may be measured by a direct-current method which permits a high degree of accuracy.—*J. B. Whitehead, Johns Hopkins University, Baltimore.*

INDUCTION MACHINES, TORQUE.

The effect of higher harmonics on the torque of induction motors is being investigated. The subject is of special importance in connection with large two-speed motors, for if the winding is connected for half speed the winding pitch becomes favorable for the development of higher harmonics in the gliding mmf. Some of these harmonics revolve against the direction of the fundamental mmf., causing the machine to start at a poor torque, and occasionally to stick at an intermediate speed.—*Alexander Gray, Cornell University, Ithaca, N. Y.*

IRON ALLOYS, COBALT.

The effect of cobalt on the magnetic and other properties of iron alloys is being studied. Specimens of alloys have been prepared with percentages of cobalt ranging from small traces up to the maximum per cent that gives a workable alloy. We hope to have the results of this investigation ready for publication before the close of the present school year.—*E. B. Paine, University of Illinois, Urbana, Ill.*

OSCILLATIONS, INTEGRAPH FOR REPRESENTING.

Prof. E. Pascal of the University of Naples, Italy, has built several planimeter devices which graphically integrate linear differential equations of the first and second order. The device which integrates the first order equation is applicable to electric transient phenomena which involve resistances and inductances only, with any irregular applied variable voltage. When capacity is present the differential equation of oscillations is of the second order. It is very desirable to develop further Pascal's integraph so as to make its application easy to electrical problems. In the present form the device is suitable for cases when the resistance is so high that the current is aperiodic. An improved device would be extremely useful in the analysis of transmission line oscillations and in the study of some radio phenomena. For information relating to the above see Ernesto Pascal, "I Miei Integrafi per Equazioni Differenziali," Naples, 1914, and A. Galle, "Mathematische Instrumente" (Teubner), 1912, p. 161. Several articles by Pascal have appeared since 1909 in the *Proceedings* of the Accademia dei Lincei. The paper on the second order equations is dated March 19, 1916.—*Editorial Suggestion.*

TRANSFORMERS FOR SERIES LAMPS.

Transformers designed to operate series incandescent street lamps are being studied to determine the variations in current resulting from abnormal conditions of the circuit, such as grounded lines, broken lamps, etc.—*E. B. Paine, University of Illinois, Urbana, Ill.*

VENTILATION OF ELECTRICAL MACHINERY.

Data on the pressure drop of air flowing through irregular passages are being obtained and collected; a simple method has been devised for measuring air velocities. The laws of heat transfer are being investigated both within the machine materials and from their surfaces to the cooling air. The specific purpose of the investigation is to enable the designer of an induction motor to predetermine accurately its temperature rise.—*A. D. Moore, University of Michigan, Ann Arbor, Mich.*

Suggestions for Research

LIGHTNING.

A miniature laboratory arrangement imitating a charged cloud and a transmission line, to study the effects of direct and indirect lightning strokes.—*Editorial Suggestion.*

MEASURING INSTRUMENTS.

An integrating kilovolt-ampere meter for measuring total apparent input. (Under some conditions, especially at low power factor, it is more equitable to charge a customer on the kva. basis than on the kw. basis. In a more general case the charge for service should consist of at least three parts, one proportional to the real input, one to the apparent input and one to the maximum demand. A kilovolt-ampere-hour meter would be serviceable in many cases in inducing the customer to maintain a high power factor, if for no other purpose.)

MINING APPLICATIONS OF ELECTRICITY.

Further development of explosion-proof motors for coal mines; suppression of arcing in mine-locomotive controllers; electrically operated reciprocating drill; self-contained portable electric lamp for miners and wider use of electricity in cutting coal and in other operations.—*A. I. E. E. Committee on the Use of Electricity in Mines.*

OSCILLATION PERIOD OF COILS.

Collection of data, mathematical or experimental, on the oscillation periods of inductance coils for use in radio apparatus. Some general conclusions should be made as to the variation of the periods of coils with changes in diameter, length, number of coils, etc.—*Louis Cohen, Washington, D. C.*

RESONANCE TRANSFORMER.

Solution for the differential equation of a resonance transformer such as is used in radio-work, with the electric spark included. The variable resistance of the spark is a function of the instantaneous current, time and possibly of other factors. Some simple function of this resistance should be assumed and substituted in the differential equation.—*Louis Cohen, Washington, D. C.*

TIE-LINE PROBLEM.

The following problem is of interest to operating companies, and it is desired to obtain a solution, analytical, graphical or combined, in such a form that even one not well versed in the intricacies of alternating-current vectors or complex quantities could apply it to his own case. Referring to the accompanying diagram, two substations are fed each with polyphase power from a station bus through one or more lines in parallel. The combined impedance of the feeders to substation No. 1 is Za, of those to No. 2 is Zb. The loads W_1 and W_2 as well as the phase angles ϕ_1 and ϕ_2 at both substations are given. The feeders to substation No. 2 are overloaded, and it is desired to add a tie line marked Zc. The problem is to find the new electrical conditions when the tie-line Zc is of a given size in operation, or to find the size that would bring about the desired relief. Of particular interest are the currents in Zb and Zc. Readers are invited to contribute solutions to this problem.—*Editorial Suggestion.*

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*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SIR ADAM BECK ON THE PENDING WATER-POWER BILL

Chairman of Hydroelectric Power Commission of Ontario Before Special Joint Committee of House of Representatives

The special joint water-power committee of the House of Representatives held another hearing on the so-called "administration" bill on April 15, with Sir Adam Beck, chairman of the Hydroelectric Power Commission of Ontario, as the speaker.

Sir Adam Beck delivered an exhaustive analysis from his own point of view of conditions relating to water-power development in the Dominion and the sale of hydroelectric energy in Ontario as compared with what he knows of conditions in the United States, dealing in detail with the situation at Niagara Falls. He delivered a strong plea for monopoly in public utilities.

He presented a number of figures tending to show that under government control in Toronto the rate for electricity is about half the rate at Buffalo, and made other comparisons between rates in the United States and in Ontario. He said he had only a faint idea of the legislation proposed in the so-called administration water-power bill now in the House of Representatives.

The hearings before the joint committee will not be closed until the committee has heard Secretary Baker of the War Department, Secretary Houston of the Department of Agriculture and any members of Congress who desire to be heard. The framing of the final bill will therefore be delayed in the committee.

Ontario's Water Power Development

Sir Adam Beck said that Great Britain is dealing with water-power development very comprehensively at this time because of coal conservation, but that Ontario is surpassing the mother country in that respect. He has been identified with water-power matters in Ontario since 1903 or 1905. He traced the growth of legislation in Canada, saying franchises were originally granted to generate power at Niagara Falls on the Canadian side as follows: To the Canadian-Niagara Power Company, 100,000 hp.; to the Electrical Development Company, 125,000 hp., and to the Ontario Power Company, 180,000 hp.

The object of the boards of trade, merchants' associations, etc., in Ontario, he said, was to make this power available generally to the people of the district, and because of the great advance in the art of transmitting energy at high voltage economically to great distances, a desire was created in manufacturing districts to have this power available for them. Sir Adam pointed out that Ontario has no coal fields known at this time and that among the power difficulties there are the necessity for long transportation and the duty on coal. These difficulties have long continued.

In 1902, he said, various civic bodies appointed a committee to confer with the Legislature on steps to enable municipalities to undertake the generation of electricity. Two years previously the Legislature had refused the city of Toronto a franchise to develop power and instead had granted such a franchise to the Electrical Development Company, which had affiliated with it the Toronto Electric Light Company and the Toronto Street Railway Company. Finally the Legislature passed an act allowing the municipalities to borrow money on their own account for power and light development, and a commission was appointed to investigate. This commission, after eighteen months' work, practically said that power could be delivered at cost; but the practical difficulty of raising money was encountered, and further rights for development were granted to the Electrical Development Company.

Sir Adam then told of changes in the government following elections and of the passage of the present acts and amendments. He said:

Drastic Powers of the Commission

"We have power to acquire, by purchase or otherwise, on any terms and hold shares in any incorporated company carrying on the business of developing, supplying and transmitting electrical energy. We have power to appropriate the lands, waters, water privileges or water powers or works, machinery and plants or portions thereof of any person owning or operating under lease or otherwise or operating or using water-power privileges or transmitting electrical power or energy in Ontario which in the opinion of the commission should be purchased, acquired, leased, taken, expropriated and developed or used by the commission for the purposes of the act. Now, that is pretty drastic, but it is all subject to arbitration."

At the present time, the chairman of the Ontario commission said, that body has contracts with 225 municipalities. They pay all interest charges at 4 per cent and a sinking fund of 1.8 per cent, which retires in thirty years. They pay all charges of depreciation, operation, administration, etc. The chairman continued:

"We operate at the present time twelve systems. They will become interconnected eventually and form one great system. In this way we are attaining the object of the whole scheme, namely, that there should be one control only."

Sir Adam declared: "We want to create a real monopoly because we believe all these service undertakings should be a monopoly. There is little satisfaction in having competition in a telephone system, or a telegraph system, or even a railway system, and certainly not in an electric system in any community.

"The obnoxious poles and wires, the great dual cost of everything and the great dual investment that results because of the diversity created by these vari-

ous corporations covering the same field is undesirable from every standpoint."

As to the Niagara situation, Sir Adam said the principle laid down by the International Waterways Commission is that there should be an equal division of water for power purposes on all international streams, and pointed out that there is now pending an application that the United States government shall confer with the Dominion authorities regarding a proposal to allot another 10,000 second-feet to each government. This, he pointed out, is advanced as a war measure and will be justified even though the most efficient use is not made of the water.

Sir Adam said he believes that if this measure is carried through it would not be canceled after the war and would stimulate production after peace. He presented figures to show that the total power now being generated on both sides of Niagara is 653,000 hp. Of this amount, 265,000 hp., he said, is generated in the United States, which also receives 110,000 hp. exported from the Canadian side, making a total of 375,000 hp. available in the United States. This amounts to 40 per cent more for the United States than for Canada, he said, although the latter country generates 100,000 more horsepower than is generated in the United States.

The chairman of the commission went on to say that there is no intention on the part of the Canadian government or on the part of the commission to interfere with the present export arrangement, even though Canada is now short about 100,000 hp. of the amount that country needs. In order to permit a continuance of the export, Canada has arranged to do away with all sign lighting, window lighting and other uses of energy which in some quarters have been characterized as less essential. He said the power generated by the Province of Ontario has reduced coal consumption between 5,000,000 tons and 6,000,000 tons per annum. Motive power has been saved, use of cars has been saved, and duty on coal has been saved.

The estimated potential horsepower of hydroelectric energy in Canada, Sir Adam says, is about 50,000,000, and in Ontario alone about 5,000,000 or 6,000,000, with but 700,000 developed. At the beginning of the commission's work in 1910, he said, only 750 hp. was being delivered to the twelve municipalities interested. The commission has acquired up to date about eighty-six corporations through friendly negotiation and without resorting to the drastic powers given to it under the act.

Carry On—Buy Liberty Bonds

Irvington Varnish & Insulator Company Insures Irvington Citizens in War

The Irvington (N. J.) Varnish & Insulator Company, as a patriotic act, has paid for $2,500 insurance under the government plan for each citizen of Irvington who has been called to the colors. The company volunteered to do this, not only for its employees who entered the service, but also for other citizens of the town. Under its offer insurance was taken for 460 people, including employees as well as other citizens of Irvington now with the military forces.

STUDY AND ANALYZE COST OF GIVING SERVICE

BY GERARD SWOPE,
Vice-President Western Electric Company

The electrical distributing business is becoming more and more one of service. The community expects good service and is willing to pay for it not only a price which will cover the cost of the service but one which will also provide a reasonable profit.

To-day, under the abnormal conditions that prevail, one of the dangers is that the business will not be studied and analyzed sufficiently. Increased expenses and extravagances will creep in, which will be difficult to reduce or eliminate when either normal or possibly for a time sub-normal conditions are at hand.

There is nothing more important for the industry than to have the individual members understand the elements that go to make up the cost of giving service to the community.

E. N. Hurley, when chairman of the Federal Trade Commission, emphasized this point and opened the eyes of manufacturers and business men in general to the great need of the recognition of its importance and the study and analysis of their own businesses.

The electrical manufacturers have worked up a comprehensive plan of cost accounting, and the electrical jobbers and the contractors are giving attention to this important phase of the work.

The electrical industry, as a whole, will be placed on a more permanently stable foundation if all the elements of the industry recognize the fundamentals involved in this question of scientific merchandising and cost of service.

DAYLIGHT SAVING FOR PUBLIC SAFETY

Report of Committee of United States Chamber of Commerce Shows That Movement Had Support of State Committees

Daylight saving was one of the topics on the program of the United States Chamber of Commerce, which held its annual meeting in Chicago last week.

The report of the executive committee on daylight saving, of which A. Lincoln Filene, Boston, is chairman, showed that this movement had the direct support of a number of state committees on public safety and defense.

The committee was unanimous in its agreement that daylight saving ought to be a permament measure to operate throughout the entire year, but it presented an alternate plan that if this suggestion were not feasible clocks should be advanced on April 1 and turned back on Nov. 30.

Since its last report the committee has received many communications from public utilities and others urging the all-year round plan as that which would bring about the greater saving.

The committee feels that the matter is well worth looking into further and suggested that it be empowered to go thoroughly into the question of extending the period of operation and take such steps as it may deem wise in carrying out its recommendations that daylight saving should be operated throughout the entire year. Already beneficial effects of daylight saving are felt and records of such savings are urged.

EXTENDING THE ELECTRIC OPERATION OF COAL MINES

Anthracite Operators Show that Great Saving of Fuel Will Follow Application of Electrical Energy in Mining

A bulletin issued by the operators of anthracite coal mines says, in forecasting larger use of electricity in their operations:

Millions of tons of coal now necessarily consumed in the mining operations would become available for general commercial uses should electricity be substituted for steam in operating the collieries of the United States. Earnest studies are now being made by experts in Washington and elsewhere to determine what can be done, and quickly, to expand electric power developments throughout the country, not only, nor even primarily, in connection with coal production, but also and mainly to meet the urgent requirements of war and other industries.

The anthracite industry is now consuming in its operations about 8,800,000 tons of the coal mined and prepared. Using steam there is no way to reduce this. It is estimated that with the entire industry turned over from steam to electricity for power, light and heat about 6,000,000 tons of such mine-consumed coal would be saved and be available to supply public demands.

Already substantial progress has been made in substituting electricity for steam in the anthracite operations. Latest complete figures show at the beginning of 1916 80,000 kw. of electric power used. This has been substantially increased since then, but there is yet a long way to go before electrical energy can be employed throughout and for all purposes.

Many anthracite companies have installed individual electric power plants to serve their own needs. It is an economic proposition, but the war demands upon electric manufacturing concerns have been so urgent that it is now virtually impossible to get additional machinery. Also it has been conclusively demonstrated, both in theory and in practice, by such leaders in electrical development as Samuel Insull of Chicago and S. Z Mitchell of New York that the central power plant makes the best and lowest cost system of supplying energy.

This is because the central plant, as the great heart of a big distribution system, which may reach out through a radius of 100 miles and more, can send the living energy of electricity to supply any and every purpose. In this way there results economy, as one use comes on when another drops off. For example, the great part of the anthracite mining load is off in the afternoon before lighting and electric railway service make their heavy demands for energy.

The anthracite industry is counting upon a big development of the central power plant as a separate and independent business, and so is loath to install individual plants requiring large capital investment, which would be largely, if not entirely, lost when central power shall become available at lower cost.

Force to the Utmost—Buy Bonds

FLOOD CONDITIONS AT BINGHAMTON STATION

S. F. Bond Tells of the Precautions Taken to Protect Power House Under Severe Flood Pressure

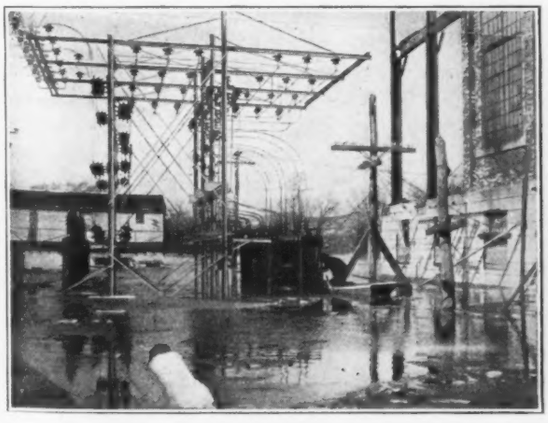
Complying with a request of the ELECTRICAL WORLD, S. F. Bond, general superintendent Binghamton (N. Y.) Light, Heat & Power Company, has furnished information regarding the conditions at the new power house during the recent flood.

The ice field in the river extended about 12 miles (19.3 km.) below the plant and contributed largely to the unusually severe flood conditions.

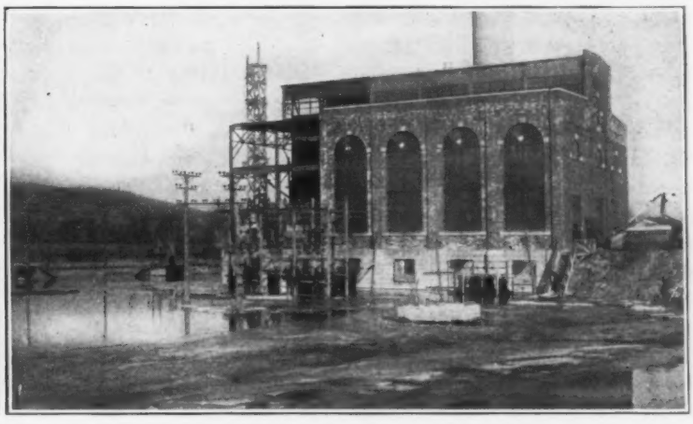
The accompanying general view of the power house was taken when the water outside of the building went 6 ft. (1.8 m.) higher than the basement floor level. The crest of the flood reached a point 1 ft. 2 in. (35.5 cm.) higher than this. The bottom of the basement windows is 7 ft. 8 in. (2.23 m.) above the basement floor, and as an additional protection flood shutters of 2-in. (5.08-cm.) plank were installed in all these windows.

The other illustration is a closer view taken at the same time, showing more clearly the condition of the 33,000-volt outdoor switching and transformer station.

The power-house building is of reinforced concrete construction up to the engine-room floor level, the walls and floor being reinforced to withstand an upward pressure due to a 10-ft. (3-m.) head of water. As practically all of the auxiliaries are placed on the basement floor, the operation of the station depends on keeping water out of the basement. There was no failure of floor or walls and only a moderate seepage at any time during the flood. A number of small leaks were checked by the use of sand bags, and when this had been done a 2-in. (5.08-cm.) ejector was sufficient to keep the basement dry. A 2-in. electric driven and a 4-in. (10.16-cm.) turbine-driven pump were, however, held in readiness for emergencies.



OUTDOOR 33,000-VOLT TRANSFORMER AND SWITCHING STATION DURING BINGHAMTON FLOOD



PLANT WITH FLOOD 6 FT. HIGHER THAN BASEMENT FLOOR; CREST OF FLOOD 1 FT. 2 IN. HIGHER THAN THIS

The great electrical industries are a vital part of the life of our nation. Their large manufacturing or producing plants, their multitudes of employees and dependents are a wholesome influence in our national life. In the crisis of war these establishments and their working forces are called upon to do without stint what they can do for the national aim of victory and righteousness. Not all are asked to risk life, but those who stay at home are privileged without exception to lend as they are able. So I say, buy the Liberty Bonds and speed the victory.

THEODORE N. VAIL,
President, American Telephone & Telegraph Company.

ENGINEERING PROGRESS IN ENGLAND IS MARKED

H. M. Hobart Recounts the Efforts Under Way to Eliminate Unnecessary Plant Expenditure and Conserve Coal Consumption

Observations upon engineering progress in Great Britain during the war were the theme of a recent informal address by H. M. Hobart of the General Electric Company at a luncheon of the Boston Section of the American Institute of Electrical Engineers, following the speaker's return from abroad. The progress of engineering in Britain has for long been extremely individual in character, he said. The electrical industry has been split up into many more divisions than in America, and the greater proportion of the small firms have aspired to manufacture many different kinds of things. A prospective customer received a large number of competitive tenders, and it was not unusual for the order to go to the firm which through faulty estimates had bid below cost. Prior to the war the electrical industry in Britain was at a low ebb. Many firms found their salvation in substituting munitions and other war work for electrical machinery. In so far, however, as they continued to manufacture electrical machinery this was done under improved conditions owing to the cutting off of German product and to the sudden demands of the Admiralty and the War Department for large quantities of electrical apparatus.

The general convulsion has brought about a serious spirit of investigation which is leading to a complete change of policy. Many new associations of manufacturers have sprung into existence, and even in cases where actual consolidations may not have been effected or in contemplation a policy of seeking to avoid destructive competition is much in evidence.

A government committee on coal conservation has been formed, and its interim report, issued in December, is of intense interest to electrical engineers. The report calls attention to the enormous waste in English electrical supply under present conditions. The public supply is obtained from about 600 undertakings, and in the London area there are over 100 generating plants selecting electricity besides nine traction stations, each supplying one of nine different railways. Two of these have each an installed capacity three times greater than would be ample for its present train service, and neither can increase this train service materially before the conclusion of the war. The plants are within a few miles of each other and in a district already provided with large, expensive, underloaded stations.

The report recommends the division of Britain into sixteen districts. Each district is to be supplied from one or more generating stations. The loads on each station will be so great as to require the installation of generating sets of some 50,000 kw. each. These superpower plants will be placed at whatever locations represent the most efficient compromise as regards condensing water supply and coal supply. Electro-chemical industries and other suitable activities will be located near these stations and their load factor will be very high.

The carrying out of this project would, according to the estimates in the report, reduce from its present value of 80,000,000 tons down to 25,000,000 the annual coal consumption for power purposes (including railways) in the United Kingdom. This is on the assumption that the same amount of power will be developed under the new plan. But the power per employee is now only half of that in the United States, and must be at least doubled if Britain is to compete successfully in the world's markets.

The report has drawn forth an enormous volume of criticism. Much of this is based on the contention that the right conditions as regards cheap and plentiful coal and plentiful water are rarely found near one another in Great Britain. Others contend that the transmission and distribution costs associated with the electric scheme will be greater than the costs of conveying the coal by rail to stations located, as at present, near densely settled areas. Others display deep concern for vested interests and protest that in any case the change ought to be spread over a very long period.

"But the prevalent temper of the British is comparable to a sort of great awakening," said Mr. Hobart, "and I venture to predict that something of this sort, or at any rate something thoroughly equivalent in bigness and boldness, will be 'pulled off.' "

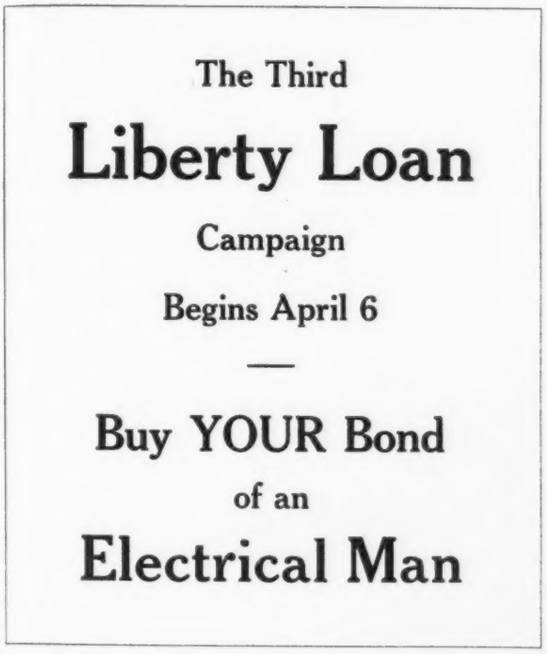
Probably a leading reason for the adoption of the national policy was that it would permit of an orderly continuance of shipbuilding and the employment of large numbers of men after the war and a freedom from the consequences of such industrial fluctuations in the demand for labor as might have occurred had private shipbuilding firms unduly extended their plants.

Closing, Mr. Hobart said that he was much impressed with the rapid progress lately made in England in the use of built-up iron-clad switch-gear as contrasted with the panel and cell systems used in America. Signs are appearing of its competition with American outfits for high-voltage work in generating stations. Although the British have finally and reluctantly taken down the sign, "Business as usual," which they took pride in displaying during the early stages of the war, an enormous amount of engineering progress is being made in Britain even in these darkest of dark days.

NEW YORK JOVIANS BUY $271,600 OF LIBERTY BONDS

Enthusiasm Marks Luncheon Meeting, Which Responds Liberally to Colonel Greenwood's Appeal —McGraw-Hill Company's Contribution

Bonds and then more bonds were bought by the New York Jovians at the inspiring appeal and demand



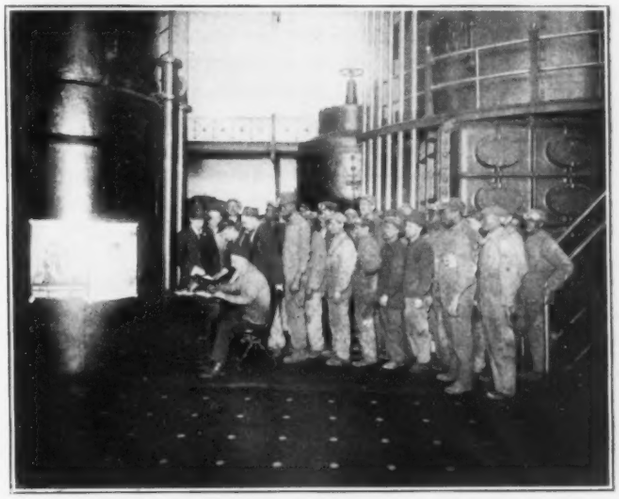
BUY ELECTRICALLY, SAYS THE NEW YORK COMMITTEE

of Col. Moses Greenwood of the George H. Beach Service Company at a midday luncheon on April 17. Colonel Greenwood said that we are fighting the German people as well as the Kaiser. Every atrocious act of the German government has been approved by its people. We are fighting for something eternal, and civilization will be overthrown if we are defeated. He placed every man in one of two classes and gave the reason why each should buy bonds. One class has relatives "over there" and should subscribe to its utmost to bring them safely home. The other class, which has no one at the front, must lend its money to keep the loved ones from going over.

The campaign for subscriptions was opened with an address by James H. McGraw, president of the McGraw-Hill Company, Inc., who pledged $250,000 in behalf of the company. In an enthusiastic half-hour following $21,600 was added to this amount by individual subscriptions.

Volunteers were called to pledge themselves to sell $500 worth each of bonds during the remainder of the campaign. Nearly every one present stood up at this call, and it was estimated that if all "came through" a total of $25,000 will be obtained.

All Over the Country Employees of Electrical Utilities Are Purchasing Liberty Bonds



STATION MEN OF THE COMMONWEALTH EDISON COMPANY, CHICAGO, IN LINE BUYING THE THIRD LIBERTY LOAN BONDS

The campaign for the third Liberty loan is now under way, and the opportunity is offered for the engineering profession in America to rise to the occasion with characteristic enterprise.

The success or failure of the engineer's part in this loan will depend not upon a few large subscriptions from some of the richer individuals in the engineering fraternity but upon the energetic co-operation of all the wiremen, draftsmen, linemen, rodmen, inspectors, superintendents, surveyors, foremen, laboratory men, students, calculators, testers and others who form the real backbone of the engineering forces of the United States; and it is to them that this appeal for subscriptions to the loan is addressed.

It is stated on good authority that there are 100,000 *engineers in this country, broadly speaking. Surely every one of these men can afford the safe investment in a United States government bond of at least* $50, *and probably much more. This would produce a substantial total.*

Let every engineer take this loan to the limit of his ability as an investment for his own welfare and for his country and in that way become a partner in the greatest and most necessary engineering enterprise ever undertaken by the United States.

H. W. BUCK,
of Viele, Blackwell & Buck.

ZONE SYSTEM TO AID IN DISTRIBUTION OF COAL

Report of the National Committee on Gas and Electric Service Deals with the Plan Effective on April 1

A report by the National Committee on Gas and Electric Service, of which J. W. Lieb is chairman, discusses in detail the zone system arranged by the United States Fuel Administration, in co-operation with the Director General of Railroads, to govern the distribution of bituminous coal during the coal year beginning on April 1, 1918.

The general effect of the zone system is to restrict Eastern coal to Eastern markets and fill the vacancy in the Central and Western States with nearby coal mined in those States.

In addition to the saving in transportation, the system will provide for the possible retention of something like 5,000,000 tons of coal for the Eastern States which heretofore has gone West, all rail. This tonnage can be readily utilized in the East. As an indication of the saving to be effected by the system, it will eliminate the movement of more than 2,000,000 tons of Pocahontas coal to Chicago and other Western points over a haul of about 660 miles. Chicago can obtain this tonnage of coal, and under this system must obtain most of it, from southern Illinois mines, with an average haul of 312 miles (502 km.). Allowing for the differences in quality in the two coals, there will thus be saved 11,400,000 car-miles or, very conservatively figured, 285,000 car-days. This will permit fourteen additional round trips of twenty days each from West Virginia mines to zone destinations, permitting an additional production of at least 700,000 tons of Pocahontas coal.

SAVINGS IN TRANSPORTATION

Similar comparisons show that on the movement of 550,000 tons annually from Kanawha districts to Wisconsin points there can be saved about 2,500,000 car-miles, with a consequent increased production of some 300,000 tons. On the movement from southeastern Kentucky to Chicago the saving will be about 800,000 car-miles and 50,000 tons in production. The elimination of the Indiana to Iowa movement will save 1,600,000 car-miles and add 100,000 tons in additional production. These are only a few of the instances of transportation saving to be effected by the system.

The movement of bituminous coal, which is regulated by the zone system, is about 300,000,000 tons, or 60 per cent of the total production. Based on this production, there will be saved on the round trip from and to the mines almost 160,000,000 car-miles. This will permit the same cars to make almost 300,000 additional trips from the mines, equivalent to an increase of 5 per cent in the production. The increase in total production in 1917 over 1916 resulting from all efforts was about 8 per cent.

A large part of the coal which the system will prevent from moving West out of the Eastern producing districts will be available for use in New England, in so far as it can be transported there. Production in the district supplying New England via all-rail routes can be increased somewhat, but there is difficulty in moving the amount of coal needed by all-rail routes, and the capacity of the rail gateways to New England has been nearly reached. Improvements now being made will increase the capacity of the Poughkeepsie Bridge route, but it is impossible to escape the conclusion that provision must be made for a much larger movement by water in 1918 than in 1917, or New England and its people and industries will suffer. This situation will be made the subject of a separate study by a committee representing the United States Shipping Board, the United States Railroad Administration, the United States Fuel Administrator, coal operators in the territory involved, the railroads involved in the movement of this coal and consumers in the territory affected.

Under regulations of the Fuel Administrator, coal of particular quality or characteristics for special purposes, such as by-products, gas, blacksmith and metallurgical coal, will be permitted to move by permit beyond the limits imposed by the zone system.

The zone system affects all bituminous coal except:

1. Coal for railroad fuel, for which special arrangements will be made by the Fuel Administrator and the Director General of Railroads.

2. Coal for movement on inland waterways, which is in no way restricted by the system.

3. Coal delivered to Canada, which is subject to regulations of the Fuel Administrator.

Other matters covered are:

The National Committee on Gas and Electric Service has been requested by the Quartermaster's Department to furnish considerable information regarding power and other equipment for the different activities of this department now under way or contemplated throughout the United States and other countries. This is also true regarding the Ordnance Department.

The notice sent out some time ago regarding the possible cancellation of all coal contracts made previous to Aug. 23, 1917, has caused considerable anxiety among public utilities and others who have such contracts. This, in connection with the zone plan, has made the situation a very serious one, and the committee has been making every effort to secure definite action and decision.

The priorities committee of the War Industries Board is endeavoring to arrange to furnish sufficient steam and electrical machinery to the several nitrogen fixation plants and powder plants that the government is erecting. This committee has been called upon in an advisory way to furnish all information possible regarding the delivery to electric light and power plants of turbine units that are now under order at the manufacturer's as it will be absolutely necessary to requisition some of this apparatus for the government. The priorities committee is particularly anxious to interfere as little as possible with the operations of public utilities, and it is in extreme cases only that it will find it necessary to take over machinery ordered by the central stations.

The information that this committee was requested by Dr. Garfield, United States Fuel Administrator, to procure as to the addresses of isolated plants operating in the territory served by central stations is being tabulated as rapidly as received. There are still many localities to be heard from.

Many communications have been received from electric light companies asking if the Fuel Administration is considering rescinding the lightless nights order, now covering Sundays and Thursdays. This matter has been under consideration with a view to possible modification for the next four months. Such action is however, being opposed by a majority of the state and local fuel administrators.

The committee will within the next few days send out to all public utilities a letter calling attention to the additional money which is to be raised by the American Red Cross and asking that every assistance possible be given to this worthy cause.

MAKE OUR WATER POWERS AVAILABLE AT THE EARLIEST DAY

[This resolution was passed by the United States Chamber of Commerce at its meeting in Chicago last week.]

Whereas the Chamber of Commerce of the United States by an overwhelming vote in its referendum No. 24 indorsed recommendations which, in its opinion, would best bring about the utilization of the potential water powers of the country; and

Whereas the war needs of the government require a large increase in power for industries, for the conservation of fuel and for transportation;

Therefore, be it resolved, that the Chamber of Commerce of the United States hereby earnestly urges upon Congress the immediate passage of legislation which will make available at the earliest possible date the water powers of the country.

ELECTRICAL CONDITIONS IN EUROPEAN COUNTRIES

Stephen Q. Hayes Tells of His Observations in Great Britain, France and Italy—Electrical Distributing Centers

"Intense activity along electrical lines has followed the course of the war in England, France and Italy, and the need of the services of the electrical engineer behind the battle lines is constantly increasing," said Stephen Q. Hayes of the Westinghouse Electric & Manufacturing Company in a talk before the Boston Section of the A. I. E. E. on April 9. Mr. Hayes recently returned from a six months' trip in England and on the Continent, where he performed electrical work for the Allied governments. Mr. Hayes said that in England business conditions are in general better than before the war. Last year England did a larger export business than before the conflict began. All efforts are concentrated on speeding up production and cutting out non-essentials.

The control boards are doing most useful work handling the output of the factories and apportioning the production of war materials of different kinds. These boards, for instance, decide what percentage of materials shall go to English, French or Italian manufacturers.

Electrical factories in England are now working up to their limit. More than twice as many persons are in the employ of the English Westinghouse shops as before the war. About one-third of the output of these shops is munitions and the rest electrical machinery and equipment. From 20 to 25 per cent more electrical work is being turned out by the factory than before the war. The demand is tremendous throughout Europe for steam turbines and small motors, and prices are fabulous.

Great interest now exists in England regarding the proposed establishment of some sixteen electrical distributing centers with large modern generating plants and interconnected networks of transmission lines for the saving of fuel. Depending upon load conditions, it is expected that the line pressures required will range from 6600 volts to 60,000 volts. There are about 600 separate municipal plants at present supplying the country which average only 5000 kva. in rating. It is estimated that 55,000,000 tons of coal could be saved yearly by interconnection and the use of units of 20,000-kw. to 50,000-kw. rating.

In the first three years of the war the electrical output in France has doubled. Hydroelectric energy is extensively used in connection with the operation of munition plants. The total estimated available water power of France is about 9,000,000 hp., and in 1916 about 1,500,000 hp. had been developed. Included in the latter were 750,000 hp. in the French Alps, 180,000 hp. in the Pyrenees district and 135,000 hp. in central France. Under construction in 1916 was 1,100,000 hp. in hydroelectric plants.

Mr. Hayes described the extensive railroad electrification work of Italy, and said that while figures of development are inadvisable for publication at this time, since the war began much has been accomplished in electrification. A point of interest is that when the British and French reinforcements were rushed to the Italian front after the collapse of the lines in the Trentino the electric locomotives on the Mont Cenis and other tunnel lines sustained from eight to ten times their normal traffic without failure. Portable power plants mounted on flat cars are used on lines near the front, the steam-generating and turbine-generator and switching equipment on separate cars. Some 100,000-volt portable substations on railway cars are in use in the war zone, and these require that the high-tension bushings of the transformers and oil switches be taken down for clearance reasons when moved. American electrical engineers are needed in the war zone.

RELIEVE THE UTILITIES FROM EXCESSIVE WAR BURDEN

[A resolution passed by the United States Chamber of Commerce at its meeting in Chicago last week.]

Whereas the maintenance of the country's public utilities in the highest possible state of efficiency is essential not only to the war program of the United States, but also to the nation's business, industrial and public interests; and

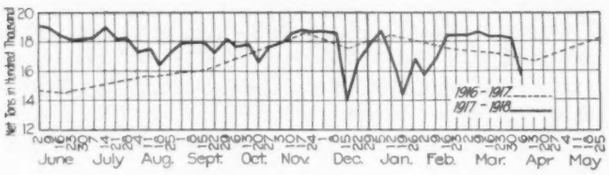
Whereas such efficiency depends upon the preservation of the credit of the companies providing public utility service; and

Whereas the increase of costs and the unusually onerous conditions of operation brought about by the war seriously threaten the ability of the public utilities to continue the furnishing of the necessary services they perform; and

Whereas the protection of the credit of public utilities is very largely in the hands of regulatory commissions and other public authorities, rather than in the utilities themselves;

Now therefore be it resolved, that the Chamber of Commerce of the United States recommends to state and local authorities that they recognize the unusual and onerous conditions with which public utilities are contending, and that in the interest of the nation, of business and of the public they give prompt and sympathetic hearing to the petitions of such utilities for assistance and relief.

Big Drop in Bituminous Coal Production



RATE OF BITUMINOUS COAL PRODUCTION IN LAST TWO YEARS

Dr. H. A. Garfield, Fuel Administrator, in a public statement declares that "unless there is immediate and material improvement in car supply efficiency the country faces the certainty of a serious shortage of bituminous coal."

Our "Will to Power"—Buy Bonds

RAISING RATES IN ORDER TO MEET HIGHER COSTS

Advance in Retail Power Rates by Minnesota Gas & Electric Company to Yield 20 Per Cent More Revenue

In making an increase in retail electric power rates the Minnesota Gas & Electric Company, Albert Lea, Minn., sent a circular letter to the customers affected and also advertised in the local newspapers, telling about the higher cost of fuel and other supplies.

H. T. Nichols, the manager, states in his letter that, after operation for months under most extreme conditions as to abnormal costs of fuel, material and labor, it is found absolutely necessary to obtain some degree of relief in the way of increased revenue to help offset very large operating expense increases. He gives the following increases:

Coal, 64 per cent; copper, 80 per cent; line hardware, 30 per cent; iron and steel wire, 35 per cent; meters, motors and transformers, 30 per cent; poles, 20 per cent; equipment and supplies, 35 per cent.

Mr. Nichols says in his letter, in part:

We had hoped that by increased efficiency and rigid economy and with an increase in the volume of business it would not be necessary to ask our customers for any assistance, and we have in this expectation carried the entire burden during the past year. Conditions have grown steadily worse, however, until we have arrived at a point where it is absolutely necessary to state the case frankly to our customers and ask them to pay an increased rate.

In the case of some customers a reduction will result in their cost per kilowatt-hour due to this rate revision, to others the increase will be almost negligible; but in the aggregate an increased revenue of something like 20 per cent should result for this part of the company's electric output.

As a matter of good business and of fairness both to yourself and the company the previous verbal agreements are to be replaced by written contracts.

It is sincerely hoped that present extreme generating costs will not long continue, and your company will receive the benefit of whatever proportionate reduction may be possible in the rate under this schedule immediately the company's fuel and material costs decrease.

For your reference we will state that the present average rate for all retail electric power costumers in Albert Lea is approximately 3.3 cents per kilowatt-hour.

The new schedule will raise this average to nearly 4 cents per kilowatt-hour.

For Freedom on Sea Buy Bonds

MEETING OF THE A. I. E. E. IN CITY OF NEW YORK

Methods of Teaching Theory of Operation of Single-Phase Induction Motor Discussed—Liberty Loan Enthusiasm

To present to the engineering student "a physical conception of the operation of the single-phase induction motor" was the object of a paper presented by B. G. Lamme before the three hundred and thirty-ninth meeting of the American Institute of Electrical Engineers on April 12 in New York. Mr. Lamme said that most engineering students are able to visualize the operation of three-phase induction motors but are utterly lost in conceiving the operation of the single-phase type. The paper gives a method of explaining the single-phase motor in terms of the polyphase machine. The action of the motor is based upon the assumption of two equal and oppositely rotating primary magnetomotive forces combined with a synchronously rotating secondary magnetomotive force such as would be produced by direct-current excitation. Under load conditions a comparison is made between a two-motor unit, consisting of two similar polyphase motors coupled together and connected for opposite rotation, and the straight single-phase induction motor. Discrepancies between the resultant actions of two outfits were removed through extensive testing.

A. M. Dudley, in the absence of the author, abstracted R. E. Hellmund's paper on "No-Load Conditions of Single-Phase Induction Motors and Phase Converters." The paper is eighty-five pages in length and is written so that it can be read without following the mathematical data. A vertical line is printed next to calculations that may be omitted without harm to the coherence of the paper. Formulas for the determination of the fields, the stator and rotor magnetizing currents and the tertiary voltages for phase converters and single-phase induction motors are derived in the paper and methods for arriving at the results are given. "The case taken by the author is extreme," Mr. Dudley stated, "but there is considerable work to be done along these lines, and it is hoped that a start has been made by the presentation." The entire paper was based on calculated results, but it was shown by tests made after the work was completed that the calculated curves agreed very closely with actual oscillogram curves.

The two papers were discussed by B. A. Behrend, consulting engineer, Boston; Dr. M. I. Pupin, Columbia University; E. L. W. Alexanderson, General Electric Company; L. W. Chubb, Westinghouse Electric & Manufacturing Company; Prof. A. M. Gray, Cornell University; Selby Harr and C. A. M. Weber, Westinghouse Electric & Manufacturing Company.

W. A. Joubert, who spoke in behalf of the third Liberty loan, was applauded for several minutes, and B. A. Behrend, who was in the chair, told of the activities of the Institute in the loan. Return cards are to be mailed to every one of ten thousand members to ascertain the amount that the electrical engineering profession subscribes. Mr. Behrend expressed a hope that the subscription would be greater than that of any other organization in the United States.

Back Those Bayonets with Bonds

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

South Dakota Electric Power Association.—The annual convention of this association will be held at the Carpenter Hotel, in Sioux Falls, on May 15 and 16.

O. E. L. A. Annual Convention.—A convention of the Ohio Electric Light Association will be held at Cedar Point, Ohio, this year. Although the time is not definitely settled, July 10, 11 and 12 have been tentatively decided upon for the meeting.

A. I. E. E., Philadelphia Section.—"Electrification of Railroads in Its Relation to Communication Lines" was the subject of an address given by H. S. Warren before the Philadelphia Section of the American Institute of Electrical Engineers on April 8.

A. S. M. E., Cincinnati Section.—"The Economic Use of Coal by Communities" was the subject of an address before the joint meeting of the Cincinnati Section of the American Society of Mechanical Engineers and the Engineering Society of Cincinnati.

A. I. and S. E. E., Pittsburgh Section.—"The Electric Furnace for Annealing Treatment and Forging of Steel" is the title of a paper to be presented to-day by W. S. Scott before the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers.

A. I. E. E., Baltimore Section.—On April 12 A. E. Bauhan, station superintendent Pennsylvania Water Power Company, delivered an address on "Power-Station Operation and Maintenance" before the Baltimore Section of the American Institute of Electrical Engineers.

San Francisco Electrical Development League.—At the regular weekly meeting of the league on April 10 Lieut. James S. Dagger, formerly of the Twenty-ninth Battalion, Canadian Expeditionary Forces, spoke on "The War on the Western Front" and "Labor and Its Relation to War."

New York Electrical Society.—Major O. O. Ellis and Major E. B. Garey gave a joint address on "Using the Motion Picture to Train the Officers and Enlisted Men of the Army" before the New York Electrical Society meeting on April 18. Hudson Maxim spoke on "High Explosives in Modern Warfare."

I. E. S., Philadelphia Section.—"Progress in Illuminating Engineering During the Past Year" was the topic of discussion by F. E. Cady of the National Electric Lamp Works, Cleveland, Ohio, and R. Pierce of the Welsbach company before the Philadelphia Section of the Illuminating Engineering Society on April 19.

Utah Society of Electrical Engineers and Dealers.—The spring convention of the Utah Society of Electrical Engineers and Dealers was held in Salt Lake on April 5 and 6. Among the important papers presented were: "The Goodwin Idea," by C. B. Hawley, Inter-Mountain Electric Company; "Merchandising of Lamps," by E. A. Evans, Westinghouse Lamp Company; "Trade Stimulation," by W. R. Putnam, Utah Power & Light Company; "Credit Conditions," by H. P. Stewart, Western Electric Company, and "The Trade Acceptance," by A. D. McMullen, Capital Electric Company.

A. I. E. E. Section Meetings.—The following are some of the important papers presented before section meetings of the American Institute of Electrical Engineers: At Pittsfield, Mass., A. C. Crehore, "Modern Consumption of Matter and Energy," April 11; Ann Arbor, Mich., Prof. J. C. Parker, "Hunting," April 12; Boston, Stephen Hayes of the Westinghouse Electric & Manufacturing Company, "European Electrical Business in War Times"; Los Angeles, J. C. Ward, superintendent of generation of the Southern California Edison Company, "Fuel Oil Conservation," April 9; Toronto, Paul Ackerman, "High-Tension Insulators from the Operating Viewpoint," April 19. Officers nominated for the Toronto Section were A. H. Hull of the Hydro-electric Power Commission, chairman, and E. C. Pannell of the British Aluminum Company, secretary.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Concurring Negligence.—Concurring negligence of a grading contractor did not absolve a city from its liability for personal injuries from electric shock caused by the city's negligence, according to the Supreme Court of Washington (170 P. 140).

Discrimination Owing to Free Service to City.—Discrimination by public service corporations is contrary to public interest, and where a requirement in a franchise that a telephone company shall furnish a municipality with free service necessitates overcharging other patrons the state, through the Public Service Commission, may modify or declare void such agreement, the Supreme Court of Indiana held (118 N. E. 531).

Contributory Negligence.—Where an employee of a cement company, while putting up steel handrails, was warned by the chief electrician of the cement company that if he touched certain power wires with the steel pieces it would kill him, as there were 22,000 volts on the line, in reversing a section of the handrail that it might be properly put in place touched the power line and was killed, he was guilty of contributory negligence, relieving the power company from liability for his death, it was held by the Supreme Court of Alabama in Dorough versus Alabama Power Company (76 S. 963).

Jurisdiction of Commission.—A proceeding by a property owner to prevent an electric light company from disturbing the surface of a street for the construction and maintenance of a conduit for electric wires, on the ground that the permit for the work issued by the board of public improvements of a city was void because of nonconformity with the conditions of the ordinance upon which it purported to be founded, and, if valid, required a certificate of public utility from the public service commission, was not within the jurisdiction of the public service commission, the Supreme Court of Missouri held in Missouri Valley Realty Company versus Cupples Station Light, Heat & Power Company (199 S. W. 151).

Discontinuance of Service Though Amount Owed Is on Deposit.—The act of a lighting company in discontinuing service without notice upon user's default for past month's service was held proper where contract provided for discontinuance on default, and it was immaterial that the amount due was not in excess of the amount deposited by user to secure faithful performance of contract, the Court of Civil Appeals of Texas held (201 S. W. 205). That one became angry because of his light service being cut off for non-payment, the service being renewed immediately upon payment and request, does not entitle him to recover for mental suffering alone, there being no personal injury, damage to property or other loss sustained.

Franchise Validity.—Under Statutes 1901, p. 265, as to granting by municipality of privilege to locate poles or wires for light or power transmission, and Sections 3 and 5, as to publication of the application for the franchise and percentage to be paid to the municipality, an ordinance purporting to grant a franchise to construct and maintain poles and wires for the purpose of transmitting and selling electricity for "light and power" was void in so far as it attempted to confer the privilege of furnishing electricity for lighting purposes, and a charge could only be made for the latter or "power" franchise, in view of the Constitution, Articles 11, 19, granting to public service corporations engaged in the sale of electricity the right to enter the streets of a city and use them for laying down pipes, etc., for the purpose of supplying electricity to the inhabitants for "illuminating" purposes, the California District Court of Appeal held in Town of Sunset versus Pacific Gas & Electric Company (170 P. 1078). As plaintiff town had no power to charge a percentage on the gross annual receipts arising from the operation of an electric system for lighting, defendant, owner of the system, would not be estopped from denying that so much of an ordinance as attempted to impose such charge was unenforceable.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Commonwealth Edison Men in Service.—On April 6, just one year after the United States entered the great war, 710 employees of the Commonwealth Edison Company had entered the military service of the United States. Men from the company are now in every branch of the military service. The company has published a complete list of the names of these men, together with their organizations.

Helping in the War by Watching the Mail.—A bulletin issued by the General War Service Committee of the Electrical Manufacturing Industry, addressed "To every electrical manufacturer," calls attention to the importance of avoiding unnecessary demands upon the government mail service. The Post Office Department has urged the committee to impress upon its associates the great advantage to both the department and the public of depositing mail matter earlier in the day and more frequently, and of having letter and circular mail, catalogs, etc., properly faced for cancellation and the short and long letters separated.

Report on General Policies of the War Trade Board.—The general policies followed by the War Trade Board and an outline of the board's labors for 1917 in the control of export and import trade are indicated in the first annual report to the President, which the board now makes public. The board has regarded trade agreements as being particularly important in the case of those European neutrals which are in trade relations with the enemy. Against these European neutrals, the report goes on to say, "temporary embargoes have been enforced pending the securing of information indispensable to permit the board to issue licenses." "The elimination of enemy advantage from our trade," says the report, "and to a considerable extent from that of the world, the securing and conserving of commodities essential to ourselves and those associated with us in the war, the bringing of shipping generally into the services most useful to us—these results cannot be accurately stated or appraised at the present time, nor have they been accomplished by any single act or agreement." The Bureau of Exports has handled approximately 425,000 applications for licenses to export and was at the date of the report passing upon between 4000 and 5000 applications per day. The Bureau of Imports, of more recent formation, had received to Jan. 1 5279 applications for licenses to import, upon which 4719 licenses, covering commodities of an aggregate value of $237,810,949, had actually been issued. The personnel of the War Trade Board numbered 1526, the report shows. The total financial obligation incurred up to Dec. 31 is $541,498.80.

Pacific Gas & Electric Directors Re-elected.—At the annual meeting of stockholders of the Pacific Gas & Electric Company on April 9 all directors were re-elected and resolutions were passed ratifying all their official acts in 1917. A detailed report on operating conditions was presented by John A. Britton, vice-president and general manager. Mr. Britton also satisfactorily answered the questions propounded in an open letter to stockholders criticising the management which was recently circulated by a former auditor of the company. The re-elected directors are: Frank B. Anderson, Henry E. Bothin, John A. Britton, William H. Crocker, Frank G. Drum, John S. Drum, F. T. Elsey, D. H. Foote, A. F. Hockenbeamer, Norman B. Livermore, John D. McKee, John A. McCandless, C. O. G. Miller, W. G. Henshaw and George K. Weeks.

Enlistment of Students of Electrical Engineering.—The Provost Marshal General has sent the following telegram to the governors of all states: "Notify all local boards of the following amendment to Section 151, Selective Service Regulations. An additional sub-paragraph is added to paragraph 'e' as follows: 'Under such regulations as the chief signal officer may prescribe, a proportion of the students in institutions in which the Signal Corps has established a course in electrical communication who have completed at least two and one-half years of the course in electrical engineering, or its equivalent, in one of the approved technical engineering schools listed in the War Department may enlist in the Signal Enlisted Reserve Corps, and thereafter, upon presentation by the registrant to his local board of a certificate of such enlistment, such certificate shall be filed with the questionnaire and the registrant shall be placed in Class 5.'"

Research Information Committee Formed.—The following statement is authorized by the Council of National Defense: By joint action the Secretaries of War and Navy, with the approval of the Council of National Defense, have authorized and approved the organization, through the National Research Council, of a research information committee in Washington, with branch committees in Paris and London, which are intended to work in close co-operation with the officers of the military and naval intelligence, and whose function shall be the securing, classifying and disseminating of scientific, technical and industrial research information, especially relating to war problems, and the interchange of such information between the allies in Europe and the United States. The Washington committee consists of (a) a civilian member, representing the National Research Council, Dr. S. W. Stratton, chairman; (b) the chief of the Military Intelligence Section; (c) the Director of Naval Intelligence.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Purchase of Lighting Companies by Public Utility.—The Indiana Public Service Commission has authorized the Indiana General Service Company, controlled by the American Gas & Electric Company, to buy the Marion Light & Heating Company, Marion, Ind., and the Muncie Electric Light Company, Muncie. The purchase price consists of the exchange of securities and the refunding of bonds heretofore issued by the companies purchased. Included in the price is $1,000,000 capital stock of the Indiana General Service Company for each of the purchased companies and the refunding of bonds of each company at par and an issuance of bonds to cover floating indebtedness of the companies. The commission announced that the transfer represents no increase in total capitalization of the companies concerned. The commission staff made a valuation of the properties to be merged, and the commissioners said that the appraisal showed that the bonded indebtedness of all companies under the merger, plus the floating indebtedness, is not increased and that this total represents only about 50 per cent of the total physical valuation of the properties concerned.

Commission Power in Ohio.—The Ohio Supreme Court is expected to hand down in a short time a ruling on the power of the Public Utilities Commission to hear appeals on utility rates from cities which operate under special charters, or so-called "home rule" cities. Should the decision of the Supreme Court be in favor of the cities, the usefulness of the commission will be impaired greatly. The case originated in the natural-gas controversy at Cincinnati. The City Council first set the rate at 35 cents. The ordinance was submitted to vote of the electors and was defeated. The Council fixed a rate of 30 cents, and the Union Gas & Electric Company appealed to the commission. This was followed by an attack on the commission's jurisdiction and the objection was overruled. The case was then taken to the Supreme Court. Oral arguments were submitted on March 6. C. A. Radcliffe, attorney for the commission, asserted that if the court holds that the commission is without jurisdiction, its usefulness will be practically ended, as there will be nothing for it to do. Lawrence Maxwell, attorney for the company, derided the plea of home rule and said that if there is not state control there will be federal control. If cities adopt confiscatory rules, he said, companies will appeal to federal tribunals and invoke the United States Constitution in the effort to maintain their rights.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. D. Ross has been reappointed as superintendent of lighting in Seattle by the City Council.

Walter D. Sultan, electrical engineer with the Pacific Gas & Electric Company for many years, has been commissioned a lieutenant in the Aviation Corps.

John B. Miller, president of the Southern California Edison Company, has, as a result of the change in titles, become chairman of the board of directors. This involves no change in his connection with the company, however.

W. Nelson Smith, who was for some years electric traction engineer with Westinghouse, Church, Kerr & Company, and recently efficiency engineer of the American Agricultural Chemical Company, is connected for the time being with Sydney E. Junkins & Company, engineers and constructors of Vancouver, B. C., as electrical engineer.

Clarence Floyd Hirshfeld, head of the research department of the Detroit Edison Company, has been commissioned a major in the Ordnance Department, Washington, D. C. He went to Detroit early in 1915 from Cornell University, where he was a member of the engineering faculty, to devote a considerable portion of his time to studying problems of electric industrial heating.

Henry D. Jackson, formerly of Timothy W. Sprague & Henry D. Jackson, consulting engineers, has joined the organization of Monks & Johnson, engineers and architects, Boston, as power engineer, taking charge of their power plant and heating work. Mr. Jackson's experience includes two years in the instrument and meter departments of the General Electric Company, four years with the Boston Elevated Railway Company, a short time with the Old Colony Street Railway Company of Massachusetts, investigation of the condition of a number of lighting plants and supervision of the changes made and consulting engineering work on power-plant construction, operation and maintenance.

Philip E. Edelman of St. Paul, Minn., has been awarded the Research Corporation fellowship in applied science on competition by a jury consisting of the president of the National Academy of Sciences, the secretary of the Smithsonian Institution, the president of the American Chemical Society, the president of the Research Corporation, and the chairman of the Engineering Foundation, upon evidence of scientific attainments, inventions and special fitness for advanced work. Mr. Edelman is an electrical engineering graduate of the University of Minnesota and has served as electrical engineer for important radio-communication interests. He is the author of "Experimental Wireless Stations" and other popular technical books, and has since February, 1917, devoted his time principally to research development work directed to increase the efficiency of the military power of the United States. He is at present working principally on important radio problems by special arrangement with the government.

F. W. Prince, for eighteen years employed by the Hartford (Conn.) Electric Light Company, has resigned as lighting superintendent to become quality expert for the Franklin Manufacturing Company. Mr. Prince was graduated from Trinity College in 1900, going with the Hartford company immediately on graduation as a lamp tester. In 1907 he became superintendent of the meter department and five years later lighting superintendent.

Townsend H. Soren, who, as reported in these columns on March 9, has been elected a vice-president of the Hartford (Conn.) Electric Light Company in charge of construction, was born in

T. H. SOREN

Boston and educated at the Boston Latin School and Harvard. He graduated with the degree of A.B. in 1893. Immediately after graduation he was employed by the General Electric Company at Schenectady and remained with that company until July, 1916, when he left to become assistant to the vice-president of the Hartford Electric Light Company. Mr. Soren's duties with the General Electric Company for a period of eighteen years were largely confined to the general supervision of the work of that company in connection with large electric railway developments in New York City. This work started with the equipment of the Ninety-sixth Street power station and substations of the Metropolitan Street Railways in 1897 and was followed by the equipment of the Manhattan Elevated Railway, the Interborough Rapid Transit Company and the Hudson & Manhattan Railway Company and the electrification of the main line of the New York Central & Hudson River Railway Company, including the construction and electric equipment of the locomotives.

J. H. Galt has been appointed assistant engineer of distribution for the Public Service Electric Company of New Jersey. He will have charge of the southern division at Camden.

Frank W. Frueauff, vice-president of Henry L. Doherty & Company, celebrated his forty-fourth birthday on March 29 at Delmonico's, New York, as the guest of 125 friends, the majority being business associates.

J. C. Rockwell has been promoted from manager of the light and power department to general manager of the Manila (P. I.) Electric Railroad & Light Company. Mr. Rockwell was graduated in 1914 from Cornell University with the degree of mechanical engineer. Following his graduation he engaged in track construction work. In 1906 he became superintendent of transportation of the Syracuse (N. Y.), Lake Shore & Northern Railroad Company. He was appointed general superintendent in 1909 of the Charleston (W. Va.) Interurban Railroad Company, and the following year was elected general manager of this company. In 1911 he joined the operating organization of the J. G. White Management Corporation, New York City, and was assigned to the Manila Electric Railroad & Light Company as manager of the light and power department.

N. J. Neall, consulting engineer, Boston, has received an appointment as major in the Quartermaster's Corps and is closing his office for the duration of the war. Major Neall was born in Philadelphia in 1875 and was graduated from the Massachusetts Institute of Technology in electrical engineering in 1900. Thereupon he entered the employ of the Westinghouse Electric & Manufacturing Company, later becoming engineer of protective apparatus for high-voltage transmission lines for the company. In 1906 he resigned from the Westinghouse company to take up consulting engineering work at Boston. Mr. Neall has been considered one of the best authorities on lightning protective equipment, and while with the Westinghouse company was associated to a considerable extent with Alexander J. Wurts, who was an authority on and inventor of lightning protective devices.

Obituary

Harry Herbert Trowbridge, general counsel for the Southern California Edison Company and head of its legal department since 1905, died suddenly at his residence in Pasadena on March 21. Before going to Los Angeles Mr. Trowbridge was connected with the legal department of the New York Central & Hudson River Railroad. The successful career upon which he had entered in New York City had to be abandoned on account of ill health, but even greater distinction awaited him upon the Pacific Coast, where as the legal representative of the Southern California Edison Company he soon became widely known as an authority upon corporation and public utility law.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

JANUARY EXPORTS LOWER THAN THOSE OF DECEMBER

Drop Noticed in Volume of Trade in Wire and Cable, Batteries and Motors—Total Exports for January Reach the Sum of $4,656,611

Electrical exports during the month of January, 1918, showed a considerable falling off from the month of December, besides being less than during the month of January, 1917. The total amount exported was $4,656,611. There was a considerable drop in the exports of wire and cable as well as a considerable decrease in the export of batteries and of motors.

Figures for the seven months ended with January show a total of $31,536,493, in comparison with $28,217,968 for the corresponding period for the year previous. The figures in the following table were compiled by the Bureau of Foreign and Domestic Commerce:

	January		Seven Months Ended January	
	1917	1918	1917	1918
Batteries	$379,781	$295,520	$1,542,053	$2,072,340
Carbons	.....	93,543	.....	*830,260
Dynamos or generators	271,742	252,429	1,466,111	1,249,074
Fans	43,660	68,541	188,521	353,481
Heating and cooking apparatus	.....	59,652	.....	*316,185
Insulated wire and cable	808,579	548,931	4,030,688	3,766,907
Interior wiring supplies, including fixtures	133,140	104,710	623,672	877,386
Arc lamps	973	671	6,951	7,315
Carbon-filament lamps	15,470	9,567	83,702	107,486
Metal-filament lamps	181,785	200,420	894,699	1,654,007
Magnetos, spark plugs, etc.	.....	380,098	.....	*2,137,946
Meters and measuring instruments	94,575	124,192	576,034	779,780
Motors	659,620	555,842	3,267,139	3,758,563
Rheostats and controllers	.....	13,007	.....	*106,619
Switches and accessories	.....	271,196	.....	*1,296,199
Telegraph apparatus, including wireless	24,808	9,208	173,388	174,102
Telephones	132,807	249,992	997,312	1,373,230
Transformers	133,539	174,001	656,341	1,179,228
All other	2,032,445	1,245,091	13,711,357	9,496,385
Total	$4,912,924	$4,656,611	$28,217,968	$31,536,493

*Included in "all other" prior to July 1, 1916.

Our Boys Go—Shall Money Fail?

ELECTRIC TRUCKS ARE IN HEAVY DEMAND AT BOSTON

Increased Cost of Skilled Labor and of Horse Feed Are Important Factors—Deliveries in Good Condition

Despite the fact that very little publicity has been given to the campaign, electric road trucks have come to be in extraordiary demand of late in the Boston district. One of the best-known dealers has sold no fewer than sixty-eight trucks within the last three months, ranging in size from 6 tons to 1 ton. In some cases deliveries have been made within two weeks of receipt of order. The increased cost of skilled labor and of horse feed are important factors in the advance of the electric truck in this territory. Recent purchasers include forwarders, grocers, iron and steel dealers, confectioners, coal merchants, milk dealers and newspaper-stock handlers. A 5-ton General Vehicle machine has just been purchased by the S. S. Pierce Company of Boston, a grocery house of national reputation which has always taken unusual pride in its horse-drawn trucks. A national advertising campaign bearing upon the electric truck is about to be inaugurated, according to well-informed sources. The Boston fire department is seriously considering the purchase of an electrically driven ladder truck and possibly other equipment, based on the success of the Couple-Gear installations at Springfield, Mass., and elsewhere. Many of the trucks lately sold are turned over on the battery service basis, the Boston Edison company carrying the battery investment and meeting charging requirements according to an established rate schedule.

Will You Lend for Human Freedom?

LOOKING FORWARD TO WORLD TRADE AFTER WAR

Banks in Monthly Letters Point Out the Steps That Are Now Being Taken by Europe, Urging Action Here

That there will be a tremendous export market after the declaration of peace is taken for granted. To what extent the United States will be represented in that market is doubtful. England and France are openly making preparations to enter it in a big way, and it is generally believed that Germany is not without some well-laid plans. In the United States little of note has been done. The Webb bill is still hanging fire, needing some real interest and enthusiasm to push it through.

This state of affairs is recognized by the banks, which are urging the manufacturers of this country to face the situation and take some action. The following excerpts are from the regular monthly letters of two of the more prominent New York City banks.

The American Exchange National Bank in urging that American manufacturers and exporters organize to take advantage of the Webb bill for pushing foreign trade in competition with other countries says:

"Germany is strengthening her cartel system, and England and France are organizing syndicates for this purpose. It will not do to wait until peace is restored. Hereafter competition in international markets will be national rather than individual, and the race is likely to be won by the nation that is best prepared before the declaration of peace."

The Guaranty Trust Company describes in its monthly letter the strenuous efforts being made by Great Britain to restore her commercial and financial position after the war. No secret is made of the fact that she expects a period of intense competition for the markets and the carrying trade of the world, the letter states, nor of her intention to be as fully prepared for it as possible. It goes on:

"In preparation for this intensive development of her resources, Great Britain is taking what is probably the most remarkable inventory ever attempted. Under the general direction of the Ministry of Reconstruction, the Ministry of Munitions, Department of the Foreign Office and Board of Trade, and other governmental agencies, nearly a hundred committees are busy collecting information regarding agricultural, mining, industrial and commercial conditions within the empire. The inquiries of these committees touch the life of the British people in all its phases."

The British banks are preparing for the demands which will be made upon them for capital to finance the program of restoration and new developments. By amalgamations, the letter says, they are concentrating great reserves of capital for a vast credit structure.

VARIOUS OUTLOOK UPON ELECTRICAL GLASSWARE

Scarcity of Labor and Fuel Supply—New Discounts and Packing Charges Formulated by Producers

Scarcity of labor and curtailment in the supply of fuel are having a restrictive effect on the output of glassware of every description. Opinions differ as to just how far current conditions may affect the stock and supply of electrical glassware for this or succeeding seasons. Wages of skilled labor in the hand and machine glass works have been advanced 25 to 30 per cent, this having become effective when the new "fire" was started early in December. Production is during the temporary federal fuel schedule down to 75 per cent of capacity. It is also reported there are some lines and sizes of glass that are already out of the market. The statement that no new electrical glassware will be obtainable in this market before April is flatly denied.

Prices are also said to be subject to a sharp rise. Inquiry at sales agencies in the East of the principal glass works of the Pittsburgh and other districts confirmed this opinion in some measure. Either higher lists or shortened discounts may be expected to prevail.

Prices quoted are f.o.b. factory, and there is no insurance of delivery or against breakage. There was a time when breakage was insured with the packing charge, but this practice has been abolished. On Feb. 1 the packing charge was increased by producers from 25 to 33 1/3 per cent. Deliveries are now six months in arrears, with the embargoes rendering shipments decidedly uncertain.

The advance spring business is stated as exceeding expectations, especially in fixture lines; in fact, representing an improvement over last year. Export trade is reported as enormous. On the other hand, plants have been running on part time only. It has been difficult to obtain as strong a skilled force of workmen as was desired, while the question of fuel has been a problem and raw material is none too ample.

METAL MARKET SITUATION

Wire Prices Will Probably Remain Unchanged—Tin Quotations Running Wild

If manufacturers of wire products for electrical uses are figuring on a higher figure for copper, and therefore an advance in the selling cost of their goods, it looks as if they are to be disappointed, with the possible exception of weatherproof. An authority of accepted standing in the metal world says that the large profits realized by the copper industry in 1917 go a long way toward offsetting the claims and arguments that are being advanced for a higher price on copper. The truth is that there is hardly a producer of standing who will go on record as saying that anything more than 23.50 cents for the metal is necessary for the welfare of the industry or the country. There is said to be no price for Straits tin, and quotations for the other kind are in consequence running wild.

NEW YORK METAL MARKET PRICES

	April 8	April 15
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25 to 26.75
Lead, trust price	7.25	7.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter spot	7.17½	6.92½ to 7.02½
Tin, Straits	*85.00	*85.00
Aluminum, 98 to 99 per cent.	Govt. price 32.10	Govt. price 32.10

OLD METALS

Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	14.00 to 15.25	13.50 to 14.00
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	6.00 to 6.25	5.75 to 6.00
Zinc, old scrap	5.00 to 5.62½	5.50 to 5.62½

*Nominal.

THE WEEK IN TRADE

HOW much the electrical trade is hampered by the slow and indefinite delivery of merchandise is not easily determined. From general reports, however, the embargoes on certain material produce trying conditions at times. Possibly this trouble may be relieved, to some extent at least, by the recent order of the Priorities Board placing on preference list No. 1 "plants manufacturing electrical equipment." The delays in shipments on electrical goods other than specified for government requisitions are occasioning shortages bordering on the acute.

Nearly every section reports that conduit is selling in excess of the supply, which also seems true of lamps (with the demand increasing in the far West), rubber-covered wire and large motors. There is also a satisfactory demand for motor sewing machines and other household devices. Jobbers are also stocking up heavily on fans, anticipating a summer of protracted heat to follow the long and cold winter.

Collections are universally conceded to be up to the mark, with credits closely looked after.

NEW YORK

Sales in regular lines for commercial uses have been halted to an appreciable extent by unusual weather conditions. The storms which have prevailed, of extreme severity for this time of year and extending over the entire eastern section of the country, have, jobbers generally say, had a deterrent effect on business. Government orders for equipment are still a ruling factor. Prices have not been affected, but stocks are far from ample.

Freight congestion has not been greatly relieved, and deliveries are the main topic of discussion. Shipments of iron and steel products are far behind. Labor shortage at the factories is also the cause of some anxiety.

Collections are reported as in fair condition, with some sections of the trade well pleased with the situation. No relaxation in the scrutiny of credits is noticed.

PAPER AND CLOTH INSULATION.—Very little change has occurred recently in paper insulation, and trade is steady. In respect to cloth, however, an entirely different state of affairs exists. With the rapid advances in cotton the price of cloth insulation has also been fluctuating rapidly. Within the last two weeks the cost was marked up from 20 to 25 per cent, and selling figures, according to influential authorities, are likely to change in forty-eight hours. Stocks are of fair size in the hands of leading producers, but with jobbers and dealers they are described as low.

COLLECTIONS AND CREDITS.—Throughout the metropolitan territory, where accounts and regular settlements receive the attention due their importance, collections are mentioned as good if not uniformly favorable. Credits are closely looked after, and the commercial rating of the buyer, especially on new accounts, is carefully weighed and considered.

LAMP FIXTURES.—Quite a volume of business is recorded for replacements and renewals of civilian equipment.

GLASS INSULATORS.—Buyers and distributers report no further price advances, and manufacturers, whose productive capacity is reduced 50 per cent by government order, seem to have enough stock to meet the demand. Of course transportation facilities are hampered by embargoes and other restrictions.

MOTORS AND GENERATORS.—On the larger sizes deliveries are yet far in arrears. Sales of the smaller-horsepower apparatus and machines, out of stock and second-

hand, represent a steady movement, the demand far exceeding the supply. Prices have not changed.

POLE AND LINE MATERIAL.—Spring work, caring for replacements, maintenance and general wear and tear of the long and trying winter in central stations, power houses and transmission lines, is well under way. Pole and line material and hardware are selling in volume up to expectations.

PORCELAIN.—No general advance has materialized, although one was anticipated by several jobbers who had been advised of a pending change by manufacturers. It seems that quite a large stock of knobs, cleats and bushings is held at the plants awaiting shipment.

CONDUIT.—With the government in the market for rigid conduit, shipments out of Pittsburgh to Eastern points are small and uncertain. The lowering of prices noted before is also reflected in flexible-steel armored conductors.

CHICAGO

The volume of the jobbers' business continues about the same, with a spotty condition particularly prevalent during the last week. Prices remain firm with no change. There is much evidence, however, which points to an upward revision of steel prices at the next revision date. These indications are taken very seriously in the Chicago district. The movement of goods still continues along the same line, with industrials active and central stations quiet. The passing of the Finance Corporation bill is expected to help central stations largely engaged in war business, but a few large plants in this territory see no way in which it will be of direct benefit to them.

CONDUIT.—The condition of the conduit market remains unchanged, the demand exceeding the supply, especially for the larger sizes.

WIRE.—One manufacturer of weatherproof wire has just placed an order for cotton at 62 5 cents a pound. With cotton at such prices it is reasonable to expect changes in wire prices.

FANS.—Some Chicago jobbers are taking on extraordinarily large stocks of fans. It is believed that a hot summer such as usually follows a cold winter will produce a market for fans this year which will clean the shelves of the industry. It may be pointed out that fan manufacturers have been limited in their production this year on account of the lack of material for making fans. When jobbers placed their orders last winter they were told by the manufacturers to state at that time their entire year's requirements, as the manufacturers would guarantee absolutely no more. Jobbers are pointing these facts out to the dealers in a spirit of helpfulness, as it is considered to be a certainty that a hot summer will produce a fan shortage that will find unprepared the dealer who has not put in his stock in advance. The most popular types of fans, judging from the jobbers' stock, appear to be the 9-in. and the 10-in. The 9-in. fan is considered a happy medium between the 8-in. and the 12-in., especially in view of the high prices of the 12-in. fans.

ELECTRIC SEWING MACHINES.—There is considerable activity in the electric sewing-machine market. Established makes are moving with a continued rapidity, and some new makes are coming into the market.

ELECTRIC RANGES.—The change in the character of the central-station load curve caused by the daylight-saving movement makes the electric range, the manufacturers contend, a more desirable load builder than ever, since it will help fill in that new and deep valley created in the load curve between 5 and 8 o'clock in the evening.

AUTOMOBILE ACCESSORIES.—The trade in automobile accessories is starting off well this spring. A very good business is expected for the year owing to the fact that most people are paying more than usual attention to the repair of existing equipment.

CENTRAL-STATION BUYING.—While financing difficulties have slowed up central-station purchasing, there are one or two projects of fairly large character in the Middle West which, it appears, may find a solution of this problem.

BOSTON

Trade continues extremely active. Collections do not show much recession on account of the Liberty loan drive, although credits are being more carefully watched than for some time. It is still very difficult to find any jobber or dealer who will testify that the freight delivery situation on the railroads shows much improvement. A movement toward increasing the coastwise shipping facilities to and from New England is taking shape, and this should supplement the railroad service in time to a most helpful degree. With the exception of conduit and porcelain, jobbers are pretty well stocked up. Little change in price was noted during the week except an advance on Hunt industrial electric trucks to conform to an increase of about 10 per cent in alkaline storage-battery prices, April 10. The contract under which William F. Kearns & Company of Boston are to construct a twenty-million-dollar United States Army waterfront terminal at Boston during the next eight months was signed at Washington April 11. A large quantity of electrical equipment for lighting and power service will be required by this great installation.

LAMPS.—The supply is slowly increasing, but the manufacturers are far from having caught up with orders. Seasonal conditions are favorable to the overtaking of demand by production in due course.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are well maintained, with government or closely allied business the basis of most orders. Shipments range in a general way from two weeks upward, depending upon the extent of departure required from standard equipment. A moderate price advance on Hunt trucks is reported, effective April 10.

VACUUM CLEANERS.—A flood of orders is pouring into the factories, and it is difficult to accumulate any considerable stock. One representative factory, visited within a few days, is working day and night and is far behind on orders. Business is being handled from the Orient, South America and the Antipodes, as well as in this country. Railroad and express shipments are slow, and many damage claims are being received. Women are being utilized in this class of production up to the point where highly technical assembly work begins. Men are required for the heavier setting-up work, and for duties of an engineering nature in vacuum-cleaner manufacture.

FANS.—The manufacturers have completed about all of this season's production, according to reliable advices. Large shipments are at present en route between the factory and the jobber, and the retailers are getting pretty well stocked up from the initial and succeeding distributions by the jobbers.

MOTORS.—A fair supply is now reported in standard equipment up to and including 20 hp. Prices are firm, with no change in sight. The demand for motors is apparently falling off slightly, but any permanent recession is hardly to be expected during the period of the war.

CONDUIT.—Nothing very optimistic can be said about the conduit situation at this time. Over and over one encounters the plaint of deferred deliveries on purchases made six to nine months back. Building operations are very flat. Fortunately temporary wiring is possible in many industrial installations handling war orders, and the needs of the international situation do not depend, so far as this class of work goes, upon putting all circuits in pipe. Ship construction is likely to demand more and more conduit within the coming summer, and the drain upon stocks is likely to be heavy even in some of the smaller sizes at present accumulated through the stagnation in house-wiring activity.

MOTOR CONTROLLERS.—Manufacturers are well ahead of the motor makers, speaking generally, on controller deliveries. Most orders can be traced to government requirements. Good shipments can be had from the factory on standard equipment, but delays are being experienced in transportation. Prices are steady, and a slight slowing down is noted in business.

INDUSTRIAL HEATING EQUIPMENT.—Despite the lateness of the season, a considerable demand is noted for heating units for out-of-the-way service.

ATLANTA

The market for large apparatus through the central stations has been comparatively dull of late, the tendency for the week being along the same line. Of course, there are exceptions, where a few companies are buying equipment for government or quasi-government account in connection with nitrate and shipbuilding work. Turbine shipment promises show no improvement. Several water-power developments have been held up temporarily owing to incomplete financial arrangements and uncertainties regarding public service commission decisions on rate increases. Although quite a number of operating companies have increased their rates so far, it is expected that the various state commissions in the Southeast will be literally deluged with applications in the near future, as it is imperative that some of these companies secure immediate relief.

The great demand for textile products from both government and commercial channels continues actively in mill construction. The Franklin Cotton Mills, Concord, N. C., have been capitalized for $1,000,000. While general building work is away off in the Southeast, certain areas show a stimulated movement, as reflected in the spotty demand for staple electrical supplies. Speaking generally, shipments are coming in slightly better when compared with the last two weeks. Jobbers report that standard goods are moving more freely. The week has witnessed a good demand from outlying sections for circular loom, knobs, tubes and standard rubber-covered and weatherproof wire.

FIXTURES.—The volume of sales as recorded in the larger cities is substantial, but a sag is noticeable in the requirements from the less populous sections. Deliveries on the whole are poor.

PORTABLE LAMPS.—Business is excellent. A singular trend of the trade which it is interesting to note is the increasing demand for floor lamps, with a corresponding decrease in the call for table portables. Shades are active, the mixed colors appearing to be growing more popular for both floor lamps and living-room portables. The solid-colored shades for small and boudoir types of portables are moving briskly as well. Deliveries on shades are reasonable compared with those now being obtained on portables.

WASHING MACHINES.—It has taken a long campaign of education for this device to "break in," as it were, but the volume of business now being transacted justifies the efforts on the part of the manufacturers and jobbers. There is no doubt that activity will continue to increase, especially as the servant problem grows more difficult each day.

SEATTLE

Despite a general lay-off to participate in the drive for third Liberty loan honors, a gratifying and sustained volume of business is reported by both jobbers and retailers. Collections were excellent and demands for credit exceeded the past several weeks. From the electrical jobbers' standpoint the past week is unmarked by any unusual developments. Sales to shipyards and allied industrial plants were heavy. New building is maintaining the pace set early in the year. The government buying dropped off considerably, but heavy sales of the past few weeks will easily offset any decrease.

Lamp, rubber-covered wire, large-motor and conduit shortages still exist. This shortage particularly is causing concern, as the demand, contrary to expectations, is still on the increase. This shortage is especially acute on lamps of larger sizes. The wire situation is accentuated materially by a heavy demand for house and industrial wiring purposes. The arrival of several large shipments recently relieved the situation temporarily, but stocks are tightening again. While the shortage in motors exists, particularly in the larger sizes, the demand is considerably less in the last two weeks. Fresh demands from two Puget Sound shipbuilding cities are anticipated shortly. Eastern manufacturers report an available supply of conduit for coast distribution, but local shortages are increasing owing to the lack of closed freight cars. Prices remain steady, with no increase or decrease expected in the near future.

Labor shortage in the Sound cities has never been so serious, according to authorities. This applies to practically every industry, and the electrical trade is not excepted. The employment of women in certain industries has afforded a measure of relief, but their capacity for work in war industrial establishments in this section is very limited. The Inland Empire Spokane district reports that unless conditions change before harvest the present labor supply will be sufficient for the increased work then. It is stated that there will be no need to bring soldiers from cantonments to help with the spring work. This step was considered.

New wooden shipbuilding companies of Seattle signed contracts for eight ships of 3500 tons capacity with French interests. Work will begin as soon as the project is sanctioned by the United States Shipping Board. An increase of 151 industrial plants under the factory inspection law in the State of Washington was last year shown by actual figures. The figures show 44,000 more men employed in industries and an increase of 2500 female employees.

Substantial progress is being made toward relief from the shortage of cars to move lumber and other products from Washington and Oregon.

SAN FRANCISCO

During the past week the momentum of electrical business, which had slowed down, again became accelerated, and several contractors whose lists of jobs on hand had dwindled to the finishing point suddenly found a long list ahead of them. The most noticeable feature of the past week's business has been the number of calls for household electrical appliances, particularly washing machines and vacuum cleaners. An increase in the range business was also reported, probably as a result of effective and patriotic advertising, for little regular effort has been made this year on account of power shortage.

Los Angeles reports that the Harbor Commission, in accordance with its determination that harbor industries are to be supplied with municipal power, has decided to refuse permits to electric lines crossing tidelands under its control, and this decision will affect a score of private power lines unless they retire from the field.

Industrial work reported during the week includes a 300,000-bag rice mill at Marysville, a new cannery at Biggs, an addition to the American Can Company's plant in San Francisco and electrical dredging and steam crane work along the Oakland estuary.

The southern California campaign having been definitely launched after the preliminary ground work, and investigation being under way in the rest of the State, a noticeable increase in the quality of electrical merchandising is evident. There is plenty of spending money on account of top wages by industrial plants and the good wages to be paid fruit and berry pickers because of scarcity of help. These facts are a stimulus to the country dealer, combined with the decreasing number of house-wiring jobs.

SEWING MACHINES.—A nation-wide advertising campaign, carried on by the largest manufacturer of portable electric sewing machines, has resulted in a tremendous business that is diverted through electrical dealers. Red Cross work and its demand for speed are chiefly responsible, but the low price of the portable electric machine has resulted in many sales. Similarly there has been a demand for sewing-machine motors only so great that local jobbers can secure only a portion of their quotas of orders at the factory. Several times there has been no Pacific Coast stock even on certain types of electric machines, this condition being attributed, first, to lack of sufficiently seasoned wood for the bases, and, second, to shortage of motors.

SWITCHES.—Knife-switch sales fall below those of last year, and a large portion of the present year's sales are attributed to the filling of back orders, based on previous demands.

ELECTRICAL FIXTURES.—Designers and manufacturers of house and hotel fixtures report that their business is poor. On the other hand, there never was such a large sale for industrial reflectors, and it is conservatively estimated that this business is running 25 per cent in advance of 1918. Stocks and deliveries are good.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to $61.00
Coil to 1000 ft	10% to 57.25
	No. 12 Solid
Less than coil	List to $71.00
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List to $104.00
Coil to 1000 ft	$97.75 to 10%
	No. 12 Solid
Less than coil	List to $135
Coil to 1000 ft	10% to $126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std pkg	10% to $24.00
1/5 to std. pkg	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	20% to List
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3275-.3295
Barrel lots	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	Net to $75.00	—15% to $69.75
⅜-in. d. stp.	+10% to 75.00	List to 72.00
½-in. s. stp.	List to 100.00	—15% to 93.00
½-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75
⅜-in. double strip	78.25-78.75	71.25-71.75
½-in. single strip	100.00	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—			
$25.00-$55.00		$20.50-$24.50	$20.00-$21.50
¼-in.—			
$28.00-$60.00		$22.50-$27.00	$22.00-$23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—			
$36.00-$55.00		$25.00	$22.50
¼-in.—			
$40.00-$60.00		$27.00	$25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12%	7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	5.3% to 8.9%	8.3% to 11.9%
2500-5000 lb.	7.3% to 10.9%	10.3% to 13.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

	Std. Pkg.	List
250-Volt		
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	20% to 30%
1/5 to std. pkg.	38% to 40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00
1/5 to std. pkg.	4.50

Standard packages, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard packages, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00 to $34.90
Coil to 1000 ft.	26.20 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $24.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, AX. 1½ 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net Std. Pkg. 3500	Std. Pkg. 4000 5½ N. C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to $11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets.	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to $23.00
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to 25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100 amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	10% to 11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List 40%	Net to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$4.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0.41¼-$0.44¼
No. 18, full spools	0.36¼- 0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11..	$15.00-$18.00	$12.50-$13.00	$9.85-$11.50
12..	23-25- 25.40	21.30- 21.80	15.95- 19.35
10..	32.40- 35.20	29.70- 30.20	22.10- 27.00
8..	45.70- 49.15	41.90- 42.10	30.88- 38.00
6..	72.40- 77.85	66.35- 66.75	48.95- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14..	$18.00	$13.00	$11.50
12..	25.33-$26.28	22.02-$25.33	18.35-$20.93
10..	30.49- 36.54	27.94- 31.26	22.86- 29.23
8..	42.54- 51.57	38.99- 44.13	31.90- 41.36
6..	66.46- 88.38	56.15- 75.61	50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.42 to $40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Brass Canopy Fixture Switch

Pass & Seymour, Inc., of Solvay, N. Y., are marketing a compact brass canopy fixture switch. The porcelain base of this device is arranged to be used on both 3.25-in. (8.2-cm.) and 4-in. (10-cm.) outlet boxes, and is fitted with an insulating lip which prevents the grounding of the brass canopy. It therefore needs no insulating ring or insulating joint. This feature makes it especially desirable for metal ceilings or walls. It is possible to loop the line wires over the terminals of the switch and carry them directly to the terminals of the unit without splicing. The brass canopy snaps on or off instantly without the use of tools. It is fastened to the base by twin spring lugs, easily located by the unobtrusive buttons on opposite sides of the canopy. It can be equipped with a nipple, porcelain bushing or fixture loop for supporting the glassware.

Variable Self and Mutual Inductometer

The inductometer produced herewith consists of two pairs of stationary coils and one movable coil, the latter being mounted on a disk placed between two outer plates holding the stationary coils. The disk may be rotated and has two scales, one calibrated in millihenries reading self-inductance, and the second in degrees. The instrument is ordinarily provided with a maximum inductance of 50 millihenries, but instruments with higher maximum values or lower values can be obtained.

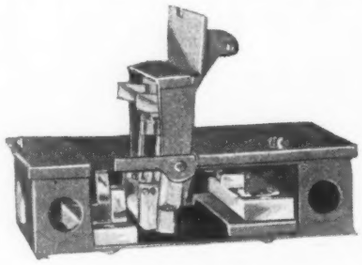
The inductometer has six link-shaped coils. The four fixed coils are mounted in pairs in the two outer fixed plates, which are held together by four screws and separating pieces to form the body of the instrument. The two movable

ROTATING DISK CALIBRATED IN DEGREES AND MILLIHENRIES

coils are mounted on the inner disk and are placed with their long axes at right angles to a diameter. The outer plates and the disk are made of molded bakelite. To use the instrument as a variable mutual inductometer the fixed and movable coils are used as primary and secondary respectively and no connection is made between them. The mutual inductance is found by subtracting a constant from the scale reading and dividing the remainder by two. This constant is given with each instrument, although it may be readily determined by the user at any time. It is claimed that errors due to stray field effects are eliminated and that the meter has a desirable ratio of maximum inductance to minimum inductance. It is made by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia.

Cut-Out Switch with Interchangeable Knock-Out

A service cut-out which consists of a knife-blade switch inclosed in metal box with interchangeable knock-outs for conduit connection is being manufactured by the Palmer Electric & Manufacturing Company of Boston. The fixed jaws of the switch are secured to the bottom of the box. The cut-out



NO CURRENT-CARRYING PARTS ARE WITHIN REACH

block and the movable jaws of the switch are secured to a hinged cover pivoted at the middle point of the box and having a flange like a letter box. When the circuit is broken by opening the hinged cover, the cut-out and fuses are exposed without making any current-carrying parts accessible. The half-tone of the box in the open position shows that it is impossible to make a "fished" connection to the service contacts. When the switch and cut-out are mounted in connection with a meter adapter the service wires are protected by conduit and no current-carrying parts are accessible although the service switch and fuse are easily accessible.

Flange-Type Cable End-Bell

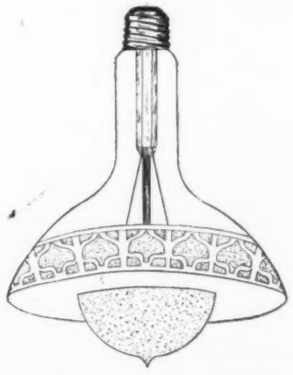
The Electrical Engineers' Equipment Company, 710 Madison Street, Chicago, has made improvements upon its cable end-bell, consisting principally of a flange which is cast about the neck of the bell where the lead-covered cable enters. This flange is arranged so that adapters can be bolted to it for mounting the bell upon any size of conduit or for any size of clamp or wiped cable joint. In case the bell is to be mounted upon conduit, a brass bushing is provided, which is clamped in between the bell flange and the flange upon the pipe adapters. The brass bushing forms the ground connection. With this arrange-

BRASS BUSHING FOR CONDUIT MOUNTING FORMS GROUND CONNECTION

ment the bell can be installed without being turned, which is an advantage, especially when the bells are to be installed in limited spaces where there is not sufficient room to revolve them. All cable end-bells being manufactured by the Electrical Engineers' Equipment Company have this feature.

Ornamental Gas-Filled Lamp

The accompanying illustration shows a unique ornamental gas-filled lamp manufactured by the Victoria Lamp



NEW GAS-FILLED LAMP COMBINES ORDINARY LAMP BULB AND SHADE IN ONE

Works, 507 Union Place, Union Hill, N. J. It is claimed that this lamp produces an indirect non-glare light which will not injure the eyes. The lamp is interesting in that it combines an ordinary gas-filled bulb with an ornamental lamp shade. The lamp, known as the

"Liberty," is made of plain white glass with ornamental decorations in green, gold, blue and other shades that will harmonize with chandeliers or room decorations.

Motor Attachment Plug for Home Devices

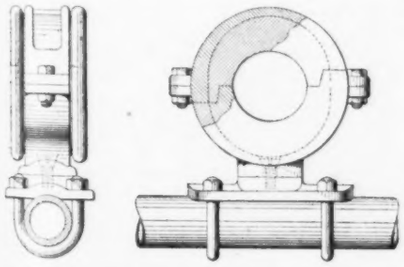
The accompanying illustration shows an exploded view of a motor attachment plug now being placed upon the market by Harvey Hubbell, Inc., of Bridgeport, Conn. The part to which the contact blades are attached has

ATTACHMENT PLUG THAT FITS IN ENERGY-CONSUMING DEVICE

slots or grooves that fit into the energy-consuming device. All current-carrying parts of the detachable portion are carefully concealed within arcing chambers to prevent accidental contact therewith. The plug is constructed of heat-proof composition and measures 1.62 in. (4.1 cm.) in length and 1.3 in. (3.3 cm.) in diameter at the bottom of the base The plug is especially designed for use with devices employing small motors such as vacuum cleaners and floor scrubbers.

Bus Support Equipped with Adjustable Base

Busbar supports which are designed to fit several sizes of insulated cable and which are also equipped with adjustable bases are being manufactured by the Lewis & Roth Company, 1012 Liberty Building, Philadelphia, Pa. The support, which is made of malleable iron, is provided with an oval hole in which various size porcelain insulators can be fitted. Thus different diameter cables can be accommodated between certain minimum and maximum limits. The insulator is constructed slightly thicker at the top and bottom than at the sides to prevent breakage when the clamp is tightened.



BUS SUPPORT MADE ADJUSTABLE TO FIT SEVERAL SIZES OF CABLE

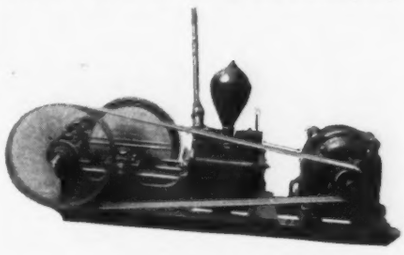
The tapered joint between the insulator sections permits considerable adjustment and allows for creepage of the cable. The part holding the insulator sections can be moved freely about an axis perpendicular to the bottom clamp, but is held in any desired position by means of a cap-screw shown in the diagram. All of the insulators are tested with two and one-half to five times actual working voltage for dielectric strength.

Transformers for Industrial Plant Illumination

The Bay Point Electrical Supply Company of Berkeley, Cal., is marketing a line of auto-transformers especially adapted for use in industrial plants. The auto-transformer changes the potential from 440 volts, the pressure usually carried on industrial-plant power circuits, to 220 or 110 volts for the lighting circuits. The transformers are made in single-phase and three-phase units, and for large sizes they are oil-cooled. In capacities of under 7500 kva. they are air-cooled.

Cam-Driven Electric Pump

A double-acting cam-driven electric pump manufactured by the Luitweiler Pumping Engine Company of Rochester, N. Y., is shown in the accompanying illustration. The double-acting feature equalizes the load pressure upon the camshaft bearings at all stages of the cycle. The absence of water-load friction in the camshaft bearings is a particular feature of the pump. The pump is geared directly to a motor on the same base and operates with practically no vibration at speeds of 75 to 250 r.p.m. when unattached to the floor. It can also be operated when hanging suspended from chains or when supported on rollers without showing vibration. The driving mechanism is inclosed within a metal case and is lubricated by the splash system.



DOUBLE-ACTION PUMP CAN BE SUSPENDED BY CHAIN OR PLACED ON ANY FLOOR

Direct Lighting Non-Glare Piano Lamp

A piano lamp that has the advantage of direct lighting and produces no objectionable glare is being manufactured by the Play-O-Lite Company, Inc., of Buffalo, N. Y. The hood is so constructed that the light rays are released only in a downward direction so as to fall upon the music rack and the entire keyboard. The "Play-O-Lite" piano lamp is made of metal and can be finished to harmonize with the woodwork of any piano. It can be easily attached to the piano and will not scratch it, because all exposed surfaces are covered with felt. The socket is of the pull-chain type and is detachable so that the bulb can be replaced at will. Another advantage that the piano lamp has is that it may be quickly removed from the piano and attached to a bed for reading after retiring.

Flexible Metallic Packing

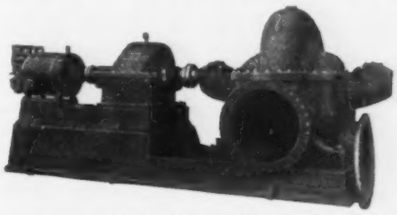
The Crane Packing Company, 29 South Clinton Street, Chicago, is marketing a flexible and compressible packing that is made of long, thin, continuous strips of metal foil and wrapping. Each strip is lubricated with oil which impregnates the sheet and permits it to slide on the adjoining strips. This construction also permits bending the packing around small-diameter bodies and gives it a compressibility sufficient to compensate for wear. It is claimed by the manufacturer that these spirally wrapped sheets form perfect barriers through which steam cannot penetrate. It is also said that this packing will reduce the rod friction and wear on the packing.

"Daylight" Glass for Reflectors and Shades

The Laco-Philips Company of 131 Hudson Street, New York City, has placed upon the market a glass product under the trade name of "Laco-daylite," which, it claims, will permit correct determination of color values. It is made by chemically treating plain glass and is made to fit standard sizes and shapes of all reflectors on the market. It is equipped with holders permitting it to be easily attached to any reflector. The advantage of this glass lies in the fact that it can be used for display purposes in department stores, and for industrial lighting where color values or accurate measurements are required.

Centrifugal Pump with End Suction

A new design of centrifugal pump manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., is illustrated herewith. The pump is interesting because of the position of the suction opening, which is directly below and in line with the end bearing. This arrangement, it is pointed out, makes it possible to place the pumping unit in a small room. Furthermore, it is convenient for inspection and upkeep.



END-SUCTION CENTRIFUGAL PUMP THAT OCCUPIES SMALL SPACE

Trade Notes

Changes in Western Electric Company's Staff

The following changes in the staff of the Western Electric Company of New York City have been announced:

G. T. MARCHMART, who has been assistant sales manager of the house at Richmond, Va., for the last four years, is now sales manager.

J. H. SYMONDS, for nearly twenty years in the service of the company, is the new stores manager at Minneapolis, Minn., where he has been for four years past.

R. A. GRIFFIN, for fourteen years manager of the pole department, on April 1 became vice-president of the National Pole Company of Spokane, Wash., with headquarters in New York.

W. P. HOAGLAND, who has been appointed sales manager of the company's Chicago house, has been connected with that branch since 1900, having been head of the supply sales work for the last seven years.

WILLIAM F. BANCKER on April 1 was made general purchasing agent of the company in New York City. He has been with the concern since 1899. C. A. Merrill, who also dates his connection with the company from that year, was promoted to be assistant general purchasing agent at the same time.

CLARK H. MINOR, whose connection with the company dates from 1902, he having been successively manager of the Kansas City (Mo.) and Omaha (Neb.) branches and more recently at Antwerp, Belgium, has been assigned to special work in China and Japan. Mr. Minor will report to G. Swope, vice-president and general sales manager in the New York City office.

HOWARD W. HALL has been transferred from Richmond, Va., to Atlanta, Ga., where he becomes Southern district manager. Mr. Hall has been with the company since 1901 and in 1906 was made manager at St. Louis, Mo., later going to Nashville, Tenn., and Denver, Col. Jay B. Odell, who has been with the company in New York City since 1904, succeeds Mr. Hall in Richmond.

GEORGE M. DUNN, manager of the company's Pittsburgh house since 1913, has been made manager at Philadelphia, succeeding Jerome D. Kennedy, who takes charge of the general sales department at Hawthorne, Ill., with the title of assistant contract sales manager. Mr. Kennedy's services with the Western Electric Company began in 1899 as an engineer in New York City. Joseph L. Ray takes Mr. Dunn's position in Pittsburgh, where he has been sales manager since 1913.

FRED B. GLEASON, for the last sixteen months Southern district manager of the company, with headquarters in Atlanta, Ga., comes to New York City as contract sales manager. He has been with the company since 1904, was manager at Dallas, Tex., four years later went to San Francisco and then to Japan, where he was Far Eastern manager. Henry L. Grant also comes to New York from Chicago for special work in the sales department. He has been with the company in various important capacities since 1905.

THE GOODYEAR TIRE & RUBBER COMPANY of Canada, Ltd., has removed its office from Toronto to New Toronto.

THE SOUTHERN CORPORATION, engineer, 40 Exchange Place, New York, announces that it has closed its office, at least for the period of the war.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY of Chicago on April 4 gave a dinner to seventy-five of its employees and their wives, after which the entire party went in a body to hear "Billy" Sunday speak at his Lakeside Tabernacle.

ROBERT S. BLAKE, formerly connected with the Condit Electric & Manufacturing Company of Boston, as its Pittsburgh (Pa.) representative, is now district manager for the Duquesne Electric & Manufacturing Company in its Chicago office at 230 South LaSalle Street.

THE GENERAL INSULATOR COMPANY of Brooklyn, N. Y., which some years ago inaugurated a bonus system among its employees that has produced excellent results, has now gone a step further and become a co-operative concern. Henceforth all employees of the company will participate in its net earnings.

THE SCHROEDER HEADLIGHT COMPANY of Evansville, Ind., has acquired control of the L. B. Jones Company of Kansas City, Mo., and will consolidate the two concerns at the former place. R. B. Holliday, formerly with the Worthington company at Milwaukee, Wis., will be the new superintendent, and E. D. Goodell, representing the Toledo (Ohio) Sales Company in Cleveland, Ohio, will be the sales manager.

THE BINDER ELEVATOR & ELECTRICAL COMPANY of Birmingham, Ala., has removed its offices from the plant and warehouse, 209-211 Twenty-second Street, North, to 305 Twentieth Street, North, where a new store has been opened. All office work for the plant, construction department and retail establishment will be handled at the Twentieth Street address, while the old building will be devoted exclusively to the electrical repairing, motor and elevator work.

THE GILHAM-SCHOEN ELECTRIC COMPANY, INC., is opening an electrical jobbing house in Atlanta, Ga., at 22 Luckie Street. The company consists of P. C. Gilham, who has been associated with the electrical jobbing interests in the South for many years, being connected with the Western Electric Company and Carter Electric Company of Atlanta, and George F. Schoen, who has since 1902 acted in the capacity of a manufacturers' agent. The company expects to be ready for business by June 1.

Trade Publications

LAMP CHANGERS.—W. N. Matthews & Brothers, Inc., of St. Louis, Mo., are distributing a circular describing their easy lamp changer and the "Fuswitch."

SHADE ATTACHMENT.—An attachment for holding two-unit shades is described in a folder issued by the E. W. Ham Electric Company, Worcester, Mass.

SWITCH PLATE.—Bulletin 574, issued by the Peerless Light Company, Halsted, Adams and Green Streets, Chicago, illustrates its combination switch and receptacle plate.

FACE AND HAND DRIER.—The Groton Electrical Devices, Inc., Groton, N. Y., is distributing a circular describing its "Airdry" electrical drier. The circular illustrates the method of drying the hands and face with the device.

FORGE BLOWERS.—Roth Brothers & Company, Adams and Loomis Streets, Chicago, are disributing a circular describing the Rothmotor forge blowers. Other electrically operated machines are also illustrated in the circular.

SPRAY-HEADS. — The Yarnall-Waring Company, Chestnut Hill, Philadelphia, has issued Bulletin No. N601, describing its adjustable spray-heads for cooling tanks. The construction and operation of the spray-heads are outlined in the bulletin.

MARINE FITTINGS.—This is the title of a circular being distributed by the V. V. Fittings Company of 1910 North Sixth Street, Philadelphia, describing its vaporproof marine fittings for shipbuilding purposes. The bulletin shows the complete line of standardized parts.

ELECTRIC ELEVATORS.—The Indiana State Soldiers and Sailors' Monument at Indianapolis, Ind., is illustrated in a circular distributed by the Warner Elevator Manufacturing Company of Cincinnati, Ohio. The balcony, which is 228.5 ft. above the ground, is reached by a Warner electric elevator.

RECTIFIERS, INSTRUMENTS AND CONTROLLERS. — The General Electric Company of Schenectady, N. Y., has issued several bulletins describing its "Tungar" rectifier for public garage and battery-charging stations, miniature direct-current instruments and drum-type controllers for railway service.

AUTOMOBILE LAMPS. — A "National Guide to Proper Lamps for Gasoline Passenger Automobiles" is the title of a booklet being distributed by the Electric Appliance Company, Chicago. Tables are presented which give the proper lamps for all cars manufactured in the United States from 1914 to 1918.

BUS SUPPORTS.—This is the title of a bulletin distributed by Lewis & Roth Company of Philadelphia, describing and illustrating a line of bus supports. The bus supports are made adjustable to accommodate various cable sizes within specified minimum and maximum limits, and are equipped with adjustable bases.

ELECTRICAL APPLIANCE CODE.—A code for construction and tests of electrical appliances has been issued by the National Board of Fire Underwriters, 207 East Ohio Street, Chicago. The book gives general information concerning the Underwriters' Laboratory and its organization, including the electrical council, the industry council and methods of procedure in examining, testing and reporting upon electrical appliances. Codes are given for wires, conduits, armature cables, cartridge fuses, map switches, cable and cut-out boxes, signs, panelboards, knife switches, cut-out bases and lugs. The book is bound in a loose-leaf leather binding and is designated as volume one.

New Incorporations

THE SPEED ELECTRIC COMPANY of Poplar, Mont., has been incorporated with a capital stock of $10,000 by M. A. Erickson and others.

THE JEFFERSON (KY.) LIGHT & POWER COMPANY has been chartered by G. E. Maddy, Fred Bobeck and R. V. Cowger. The company is capitalized at $2,000.

THE AL-CO OIL, GAS & ELECTRIC COMPANY of Aline, Okla., has been incorporated with a capital stock of $100,000 by L. J. Dixon, L. H. Stephens and I. A. O'Shaughnessy.

THE IRVINE (KY.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $80,000. The incorporators are: John J. Langan, Minnie Langan and J. Floyd Rogers.

THE MINGO COUNTY UTILITIES COMPANY of Williamson, W. Va., has been incorporated with a capital stock of $5,000. The incorporators are: S. G. Kilburn and others.

THE LEONE DUAL LIGHTING & IRRIGATION COMPANY of Seattle, Wash., has been incorporated with a capital stock of $50,000 by C. P. Gorman, J. G. Brown and W. H. Angel.

THE NORTH McDONOUGH LIGHT & POWER COMPANY of Good Hope, Ill., has been incorporated by J. E. Lowe, Alvah Allison and G. W. Staph. The company is capitalized at $10,000.

THE AUTOMATIC CHANGEABLE ELECTRIC SIGN COMPANY of Gettysburg, Pa., has been chartered with a capital stock of $5,000 to manufacture electric signs. H. L. Snyder is treasurer.

THE APPLIANCE SALES COMPANY of Williamsport, Pa., has been incorporated with a capital stock of $9,000 to manufacture electrical appliances, etc. J. P. Haag of Williamsport is interested in the company.

THE J. L. BERTSCH COMPANY of Boston, Mass., has been incorporated by J. L. Bertsch, R. B. Walsh and J. J. Murphy. The company is capitalized at $15,000 and proposes to manufacture electric and gas fixtures.

THE MICHIGAN VALLEY LIGHT CORPORATION of Grand Rapids and Detroit, Mich., has been chartered with a capital stock of $40,000 by R. H. Williams of Detroit, R. E. Becker and Thad Manning of Grand Rapids.

THE INTERNATIONAL ELECTRIC COMPANY of Indianapolis, Ind., has been chartered by Gordon B. Tanner, Fred Sterling, Jr., and M. H. Tanner. The company is capitalized at $20,000 and proposes to manufacture electrical machinery.

THE PENN MILLS, JEFFERSON, AND BERNVILLE LIGHT, HEAT & POWER COMPANIES of Bernville, Berks County, Pa., have been granted charters. Each company is capitalized at $5,000. William Kalbach is treasurer of all the companies.

THE GALENA (MD.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by Allison P. and Raymond Prettyman, Lawrence R. Vansant, James D. Davis, Harry A. Bolton and Harry S. Dempsey. The company is capitalized at $10,000.

THE DYNAMO & MOTOR EXCHANGE, INC., of Buffalo, N. Y., has been incorporated by Frank Martin, John H. Farrell and Albert J. Bissonette, 314 Wyoming Avenue. The company is capitalized at $10,000 and proposes to deal in dynamos, electrical equipment, etc.

THE MILFORD (N. H.) COMPANY has filed articles of incorporation with a capital stock of $5,000,000 for the purpose of building a hydroelectric power plant in the southern part of New Hampshire. The incorporators are: Joseph C. Donovan, J. Edward Flynn, Peter J. King and Robert Upton, all of Concord.

New England States

RUMFORD, ME.—Work has begun on the construction of a plant to manufacture ferrosilicon in Rumford. The company has entered into a contract with the Rumford Falls Power Company for 3000 hp. (electrical) to operate the proposed plant. Dudley Harde of New York, N. Y., is promoter of the project.

GOFFSTOWN, N. H. — The Manchester (N. H.) Traction, Light & Power Company has begun work on the construction of its new power house and dam in the Greggs Falls district at Goffstown. French & Hubbard, 88 Pearl Street, Boston, Mass., are engineers.

BRATTLEBORO, VT.—The Village Commissioners are considering a proposal submitted by the Twin State Gas & Electric Company for installing a new street-lighting system. The company offers to remove the arches of 20-cp. lamps and the 100-cp. lamps on poles now in use and to substitute 250-cp. lamps.

MIDDLEBURY, VT. — Plans are being prepared by the Hortonia Power Company of Rutland for the construction of a new power house, 25 ft. by 90 ft., at Middlebury. Grover & Connor of Rutland are engineers.

BOSTON, MASS.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a new power plant at the local navy yard, to cost about $35,000.

CAMBRIDGE, MASS. — The Cambridge Electric Light Company has awarded contract for the construction of addition to its boiler plant to the John F. Griffin Company, 17 Milk Street, Boston, Mass. The cost is estimated at about $20,000.

LEE, MASS. — The Pittsfield Electric Company has taken over the control of the Lee Electric Company. No change, it is understood, will be made in the local service at present.

SHERBORN, MASS.—Bids will soon be asked by the Director of Prisons, State House, Boston, for the construction of a central heating plant in the Sherborn Reformatory, to cost about $68,000. The proposed work will include power house, tunnel for pipes, etc. The R. D. Kimball Company, 6 Beacon Street, Boston, is engineer.

WESTFIELD, MASS.—At a special town meeting held April 8 the citizens voted to close down the municipal electric generating plant and to purchase energy to operate the local system from the Turners Falls Power & Electric Company. The town also voted to appropriate $42,000 to purchase the necessary equipment to enable the Municipal Light Department to utilize power from the Turners Falls plant.

HARTFORD, CONN.—The Arrow Electric Company is contemplating the construction of an addition, 80 ft. by 125 ft., three stories, to its plant, and also a concrete coal pocket, 35 ft. by 60 ft.

NORWICH, CONN. — The Eastern Connecticut Power Company has acquired what is known as the Rogers farm at Browning Beach, on which, it is said, it will erect a large power plant immediately. This is the power plant which the company is reported to have intended to build at Thamesville.

NORTH GROSVENOR DALE, CONN.—Contract has been awarded by the Grosvenor Dale Company to the J. W. Bishop Company of Worcester, Mass., for alterations in its power house, to cost about $35,000.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by Dr. Herman M. Biggs, commissioner of health, Department of Health, Albany, until May 8, for heating, sanitary and electric work for the Laboratory Building, Division of Laboratories, State Department of Health. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

COOPERSTOWN, N. Y. — The Southern New York Power & Railway Corporation has petitioned the Public Service Commission for authority to execute a first mortgage to the Equitable Trust Company of New York as trustee, to secure an issue of $5,000,000 in bonds. Also for an amendment to a prior order of the commission to authorize the immediate issue of $952,000 in bonds in exchange for outstanding bonds and the issue of $48,000 additional bonds upon the acquisition of a like amount of the capital stock of the Southern New York Power Company. The remaining $4,000,000 in bonds is to be issued from time to time for the acquisition of additional property and for extensions and improvements to its system.

CORTLAND, N. Y. — Plans have been filed by the New York Telephone Company for the erection of an addition to its local exchange building, to cost about $25,000. The contract for the work has been awarded to the Pulford & Dempsey Construction Company, 157 Flack Street, Elmira.

GLENS FALLS, N. Y.—Plans are under consideration by the Adirondack Power Company for the construction of a new power station near Utica.

OGDENSBURG, N. Y.—The local power house of the New Jersey Zinc Company was recently destroyed by fire, causing a loss of about $300,000. Plans are being considered by the company for rebuilding the plant immediately.

PORT CHESTER, N. Y.—Contract has been awarded by the Liberty Electric Corporation for the construction of an addition to its plant, 60 ft. by 100 ft., one story high, to cost about $8,000.

SCHENECTADY, N. Y. — Contract has been awarded by the General Electric Company to the Austin Company, Euclid Avenue, Cleveland, Ohio, for the construction of a 300-ft. extension to its plant.

YONKERS, N. Y. — Contract has been awarded by the National Sugar Refining Company, foot of Main Street, for addition to its boiler plant to Lynch & Larkin, 127 Downing Street, Yonkers. The building will be about 85 ft. by 95 ft., and will cost about $40,000.

CAPE MAY C. H., N. J.—The Board of Utility Commissioners has issued notice to the Vulcan Heat, Light & Power Company to continue service to customers already connected with its system; also to make improvements to the equipment in its plant.

ELIZABETHPORT, N. J.—Contract has been awarded by the Singer Manufacturing Company, 149 Broadway, N. Y., to the Austin Company, Bulletin Building, Philadelphia, for the construction of an addition, 200 ft. by 600 ft., to its works at Elizabethport, to cost about $300,000.

PERTH AMBOY, N. J.—The Public Service Electric Company has recently completed the installation of new equipment, consisting of a new exhaust steam condenser, having a cooling surface of 16,500 sq. ft., a 10,000-kw. turbo-generator and auxiliary apparatus. The company, it is said, is planning further extensions to the plant.

WEST ORANGE, N. J.—Plans have been filed and contract awarded by Thomas A. Edison, Inc., Lakeside Avenue, to the Underpinning & Foundation Company, 290 Broadway, New York City, for the construction of foundations and superstructure for a new power house, 100 ft. by 100 ft., one story high.

BRISTOL, PA. — The Town Council is considering changing the motive power of the municipal pumping station from steam to electricity.

ERIE, PA.—Bids will be received by the Board of Education, Erie, until April 29 for general work, heating, plumbing and electric work for the new East High School shop wing. Plans and further information may be obtained on application to the board at Erie or to William B. Ittner, architect, St. Louis, Mo.

MAUCH CHUNK, PA.—Plans are under consideration by the Town Council for improvements to the electric street-lighting system.

MIDDLETOWN, PA.—The War Department is contemplating the construction of a new ordnance plant at Middletown, near Harrisburg. The plans provide for the erection of 30 buildings.

NEW CASTLE, PA.—The South New Castle Electric Company, recently incorporated with a capital stock of $5,000, proposes to operate an electric plant in New Castle. J. C. Chesnut is interested in the company.

NEW CASTLE, PA.—The Grasdelli Powder Company of Cleveland, Ohio, is contemplating the construction of a new powder plant in New Castle. The proposed plant will cost about $750,000 and will consist of eight individual units, with power plant.

PHILADELPHIA, PA.—Plans are being considered by Hugo Bilgram, 1217-33 Spring Street, for the construction of a new machine shop, to cost about $100,000.

PHILADELPHIA, PA. — Contract has been awarded by the George W. Smith Company, Forty-ninth and Botanic Avenues, to John N. Gill & Company, Otis Building, Philadelphia, for the construction of an addition to its boiler house, to cost about $35,000.

PHILADELPHIA, PA.—The contract for electrical work in connection with the new school building now being erected at Fifty-seventh and Haverford Avenues has been awarded to James F. Buchanan Company, 1719 Chestnut Street. The cost of the building is estimated at $113,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 22 under specification 2867 for furnishing three electrically operated traveling cranes for air craft factory. Extension of date from March 28. The cost is estimated at $56,000.

PHILADELPHIA, PA.—The Louis Walther Manufacturing Company, Torresdale Avenue and N Street, has awarded contract for erection of addition to its boiler plant and other improvements to George H. Thirsk, 1919 West Berks Street, Philadelphia. The cost of the entire work is estimated at $21,000.

PHILADELPHIA, PA.—Tentative plans have been prepared for generating electrical power at the mines and transmission of same to Philadelphia, New York and other cities. The proposed plans provide for extension of some of the plants as soon as possible at the mines to develop at least 100,000 hp. as the first step. The second step will be to construct two or three plants of 100,000 kw. capacity. It is proposed to connect with the transmission lines of the Philadelphia Electric Company and those of the Public Service Corporation of New Jersey. The plan also embraces a proposal to connect with the lines of the large power stations in New York and Newark. Nothing definite has yet been decided upon. William Potter, state fuel administrator, Charles E. Stuart, public utility engineer of the fuel administration, S. Z. Mitchell and R. J. McClelland of New York, N. Y., are interested in the project.

READING, PA.—The Metropolitan Edison Company has begun work on the extension of its transmission line to the mine of the E. & G. Brooke Iron Company at Birdsboro, a distance of 6 miles. The company has recently equipped the mine for electrical operation and will require about 500 hp.

BALTIMORE, MD. — Plans have been submitted by the Consolidated Gas, Electric Light & Power Company to contractors for estimates for the construction of an additional unit at its Westport plant. The plans call for a building, 220 ft. by 100 ft., four stories, of concrete and steel construction.

ALEXANDER, VA. — Contract has been awarded by the American Shipbuilding Company of Alexandria, recently incorporated with a capital stock of $10,000,000, for the erection of its proposed shipbuilding plant at Jones Point, on the Potomac River, near Alexandria. The present plans provide for six shipways, a steel fabricating plant, 200 ft. by 400 ft., and a machine shop, 75 ft. by 200 ft. Colon H. Livingstone of Washington is president.

WILLIAMSBURG, VA. — The capital stock of the Williamsburg Power Company has been increased from $25,000 to $150,000, the proceeds to be used for extensions and improvements.

WASHINGTON, D. C. — Contract has been awarded by the War Department, Washington, amounting to about $800,000, for airplane works at Montgomery, Ala., West Point and Americus, Ga. The total cost of the plants is estimated at over $2,000,000. They will consist of assembling and repair work shops, including machine, foundry and other shops.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1774—205,000 ft. rubber-insulated lighting and power wire, 600 volts and less. Mare Island, Cal., Schedule 1776—400 yards plain muslin insulating tape. Various, Schedule 1771—124 electrically driven, 110 and 120-volt sewing machines. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—The War Department, it is reported, is considering the construction of additional nitrate plants, involving an expenditure of $500,000,000, in addition to the $30,000,000 and $5,000,000 plants at Muscle Shoals. One of these plants, it is understood, will be erected at

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

or near Lock Twelve on Warrior River and another at Kingsport, Tenn. The cyanamid process will be used. Electricity will be obtained from the Alabama Power Company of Birmingham, Ala., for the plant at Kingsport, and the Georgia Power Company of Atlanta, Ga., for the Lock Twelve plant.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 22, for furnishing at the various navy yards and naval stations supplies as follows: Eastern navy yards, Schedule 4040½—portable electric hand lanterns. Mare Island, Cal., Schedule 4015½—5000 ft. telephone cable and a miscellaneous quantity of electric cable; Schedule 4075½—3719 ft. three-conductor cable. Brooklyn, N. Y., Schedule 4027½—20 electrically driven winches; Schedule 4076½—20,000 ft. electric wire. Washington, D. C., Schedule 4072½—telephone cable. Bids will be received also until April 29 as follows: Washington, D. C., Schedule 4023½—for 20 motor-driven lathes. Mare Island, Cal., Schedule 4034½—magnet wire, 22,000 ft. rubber-insulated lighting and power wire, 200 lb. slow-burning wire, 2000 ft. lighting and power wire, 700 ft. switchboard cable and 1600 ft. ignition copper cable. Eastern navy yards, Schedule 4045½ — battery charging panels. Eastern and Western navy yards, Schedule 4050½—2000 turret lighting fixtures and 1000 magazine lighting fixtures. Washington, D. C., and Brooklyn, N. Y., Schedule 4083—eight reels antenna wire, 600 ft. each, for Brooklyn and 100 radio spark transmitters. Charleston, Mare Island and Philadelphia, Schedule 4088½—3850 lb. brass tubes and sheet copper. Philadelphia, Pa., Schedule 4089½—electrical supplies. Bids will also be received until May 3 for the following supplies: Washington, D. C., Schedule 4098½—for four electric centrifugal machines. Applications for proposals should designate the schedule desired by number.

North Central States

CHARLEVOIX, MICH. — At an election held recently the proposal to issue $85,000 in bonds to purchase the hydroelectric plant at Bellaire was carried.

ONSTEAD, MICH.—A new electric-light plant has recently been installed in Onstead.

CINCINNATI, OHIO.— The plant of the Hamilton & Rossille Company, west of North Front Street, will be removed from its present site in Cincinnati to the Baltimore & Ohio Railroad Company. The company, which formerly furnished water power, is planning to supply electricity in the near future.

CLEVELAND, OHIO. — Plans are being considered by the Cleveland Hardware Company for the construction of an addition, 40 ft. by 200 ft., to its machine shop.

SALEM, OHIO.—The Salem Lighting Company, which has been constructing a large addition to the local electric power plant and erecting a high-tension transmission line to supply energy to the plant of the Morgan Engineering Company in Alliance, 14 miles distant, it is reported, has received instructions from Washington to cease the work. A large part of the addition has been built and several miles of poles set between here and Alliance.

SAVANNAH, OHIO.—The local electric-light plant, town hall and a number of other buildings were recently destroyed by fire. The total loss in estimated at about $50,000.

TROY, OHIO.—The electrical plant, owned by Hobart Brothers, was recently destroyed by fire, causing a loss of about $10,000.

MOUNT OLIVET, KY. — The Mount Olivet Electric Light & Power Company is contemplating the installation of either a storage battery or a smaller (15-hp.) engine and a 10-kw., 220-volt direct-current generator. Joseph H. Kain is owner.

WHITESBURG, KY.—The Powell Coal Company, recently organized with a capital stock of $300,000, has leased several thousand acres of coal land which it will develop. The plans provide for the installation of an electrically driven plant and establishing a town site, to cost about $500,000. Charles Powell, Louisville, president.

INDIANA HARBOR, IND. — Contract has been awarded by the Standard Forging Company, East Jackson Street, Chicago, Ill., for construction of a new engine house and other buildings at Indiana Harbor, to cost about $15,000.

HARRISBURG, ILL.—The Southern Illinois Light & Power Company has been granted permission by the Public Utilities Commission to issue $94,300 in bonds.

MATTOON, ILL. — The Public Utilities Commission has authorized the Central Illinois Public Service Company to issue $75,000 in gold notes.

APPLETON, WIS.—The Standard Manufacturing Company is planning to erect a new factory building, 120 ft. by 120 ft., to cost about $75,000. New equipment, including electric motors, etc., is being purchased.

MILWAUKEE, WIS.—A brick and steel forge shop, 150 ft. by 200 ft. and 175 ft. high, for the production of propulsion shafts for government shipbuilding, is being erected by the Allis-Chalmers Manufacturing Company. The new shop is being built around the present forge shop. An 80-ton electric traveling crane with a runway of 200 ft. will be installed.

SHEBOYGAN, WIS. — Plans are being prepared by Juul & Smith, architects, for a new power house, machine shop and garage, 76 ft. by 130 ft., for the Badger State Tanning Company. Bids for the work, it is understood, will soon be asked.

MINNEAPOLIS, MINN.—Contracts will soon be awarded by J. C. Thompson, 118 North Broadway, for construction of garage and machine shop, 66 ft. by 140 ft., to cost about $35,000.

NORWOOD, MINN. — Arrangements are being made by the Northern States Power Company of Chicago, Ill., to supply electrical service in the town of Norwood. The local municipal gas plant has been ordered closed down by the state fire marshal.

FARGO, N. D. — The City Commission has authorized J. J. Jordan, city engineer, to prepare estimates of the cost of installing an electric light plant at the municipal waterworks station for lighting the city streets. The city attorney has also been instructed to draw a bill to be presented in the next State Legislature empowering cities to own and operate municipal electric-light, heat and power plants and to sell direct to consumers. Under the present law cities can only operate lighting plants.

ABERDEEN, S. D.—Bids will be received by W. E. Johnson, president of the regents of education of the State of South Dakota, Aberdeen, until April 27 for construction of Lincoln Hall on the grounds of the Northern Normal and Industrial School, Aberdeen, including arcade, boiler house, lighting fixtures, etc. Plans and specifications are on file in the office of George F. Foster, architect, Aberdeen.

SIOUX FALLS, S. D.—The contract for electric wiring for parish house and sacristies of the Sioux Falls cathedral has been awarded to the Olsen-Boettger Electric Manufacturing Company, 413 North Franklin Street, St. Paul.

Southern States

OLDSMAR, FLA.—The Oldsmar Electric & Ice Company, recently organized, contemplates the installation of an electric-light plant and ice factory. Jacob Bornstein is president.

KINGSPORT, TENN.—Arrangements are being made by the War Department, Washington, D. C., for the construction of a nitrate plant on a 2000-acre site on the Carolina, Clinchfield & Ohio Railroad and the Kingsport Farms Corporation property, to cost about $10,000,000.

NASHVILLE, TENN.—The Cumberland Power Company, recently incorporated with a capital stock of $100,000, proposes to construct and operate an electric plant in Nashville. K. E. Longfield, F. D. Buck and others of Wilmington, Del., are interested in the project.

ALEXANDER CITY, ALA.—At an election held recently the proposal to issue $10,000 in bonds for improvements to the municipal electric-light plant was carried.

EUFAULA, ALA. — Contract has been awarded by the Eufaula Farm Products Company for a fireproof building, to cost about $40,000. New equipment, including elevator machinery, engine, boiler, feed mill, dryer, peanut sheller, corn shucker and steam plant, will be installed.

CORINTH, MISS.—Bids will be received by the Board of Supervisors of Alcorn County, Corinth, until May 8 for heating, plumbing, lighting and clocks for the new court house, now under construction at Corinth. Plans and specifications may be obtained from N. W. Overstreet, Jackson, upon deposit of $10.90.

PURVIS, MISS.—The City Council has engaged Xavier A. Kramer, engineer of Magnolia, to prepare plans for the installation of an electric lighting system in Purvis.

HARRISON, ARK.—The Harrison Gas & Electric Company, recently reorganized with R. M. Fellows, president, is planning to extend the electric-lighting system, and to enlarge the cold storage plant and ice factory.

POWHATAN, LA.—The Yarbrough Company of Powhatan is contemplating the purchase of Scotch boilers and other power plant equipment.

HARTSHORNE, OKLA. — The Choctaw Power & Light Company of McAlester is contemplating installing an electric-lighting system in Hartshorne.

KIOWA, OKLA.—The Kiowa Ice, Light & Water Company, recently incorporated with a capital stock of $50,000, it is reported, is planning to install an electric plant and ice factory. L. T. Sammons, Milo T. Crane and others are interested in the company.

PERRY, OKLA.—The Council is considering calling an election to submit the proposal to issue bonds for improvements to the municipal electric-light plant and water-works system.

STILLWATER, OKLA.—Plans have been prepared by H. A. Pressy, engineer, Oklahoma City, for improvements to the municipal electric-light system, to cost about $30,000. Improvements will be made to the waterworks, involving an expenditure of about $101,000, and will include four 8-in. three-stage centrifugal pumps, reservoir, filtration plants, etc.

STILLWATER, OKLA.—Bids will be received by F. M. Gault, president of the State Board of Agriculture, Capitol Building, Oklahoma City, until May 2 for construction of science hall and armory-gymnasium building at the Agricultural and Mechanical College. Separate bids to be submitted for heating and plumbing. The general contract includes electrical work, etc. The cost of the building is estimated at about $200,000. F. W. Redlich of Stillwater is architect.

BREMOND, TEX. — The Calvert (Tex.) Water, Ice & Electric Company is contemplating extending its electric power transmission lines to Bremond and installing an electric distributing system here.

DALLAS, TEX.—Smith & Whitney, 1405 Southwestern Life Building, Dallas, it is reported, would like to receive prices on a 300-kw., 250-volt, two or three-wire, direct-current generating set; engine to be cross compound, non-condensing, non-releasing Corliss type. An engine type generator without engine, but for direct connection to engine of above type, would be considered.

PLEASANTON, TEX.—The City Council has taken over the plant of the Pleasanton Ice & Electric Company and will install additional equipment and machinery.

Pacific and Mountain States

CENTRALIA, WASH. — The City Commission has awarded contract to the Devore Electric Company for furnishing street lamps to the city for one year.

SEATTLE, WASH. — The City Council has granted the National District Telegraph Company a franchise to install and operate a system in Seattle.

SNOHOMISH, WASH. — Among the improvements being made at the plant of the Snohomish Dairy Products Company is the installation of electric motor in several departments. Energy is supplied by the local company. An electric laboratory, with testing appliances, including an electric vacuum oven and computing instruments, has also been installed.

COTTAGE GROVE, ORE. — Machinery has been received by the Cottage Grove Electric Company which, when installed, will double the present output of the plant.

MONDOVI, ORE. — The Washington Water Power Company of Spokane is contemplating extending its electric transmission lines to supply electrical service in Mondovi and surrounding territory.

PORTLAND, ORE. — The Northwestern Electric Company has awarded contract for waterproofing the foundation walls for the power plant under construction in South Portland to the Portland Roofing Company.

FRESNO, CAL.—In order to meet the increasing demands of the oil companies for electrical service in the Kern River field the San Joaquin Light & Power Company is erecting a new substation just east of the Standard reservoir farm. This station will transform current transmitted from the Crane Valley power house district at 60,000 volts to the lower voltage required in the oil field operation. The equipment will consist of four 1000-kva. transformers with necessary switches, etc.

LOS ANGELES, CAL.—Plans and specifications for competitive bids for ornamental

lighting of more than 50 miles of the streets of Los Angeles have been approved by the Board of Public Works. Resolutions have also been submitted for supplying aqueduct power for the ornamental lamps on Broadway from California to Tenth Streets. The Municipal Power Bureau will be awarded this contract as there were no bids submitted when called by the board. The contract amounts to more than $30,000, as globes and other equipment for the ornamental lighting system on Broadway will be included.

LOS ANGELES, CAL. — Funds to the amount of $79,000 have been provided by the City Council for the completion of the distribution of municipal hydroelectric power at the harbor. The skeleton of the system, including the high-tension feed wires, has been installed, but the money was lacking for installing the laterals and local distributing wires. The Power Department will expend $34,000 in extending the system to the fish harbor and the balance will be utilized in gridironing the tidelands with service wires. Under a recent order of the Mayor and the Harbor Commission none but municipal power can be used at the harbor.

PASADENA, CAL. — The City Commission has approved the proposed contract with the Southern California Power Company whereby the city of Pasadena will lease the distributing system of the Edison company for a period of two years, with the privilege of buying it at the expiration of the contract. If approved by the State Railroad Commission the contract will become effective May 3.

RIALTO, CAL.—The Railroad Commission has granted the Rialto Light, Power & Water Company permission to sell its properties to the Southern Sierras Power Company for $25,784. The Rialto Company furnishes electricity in and about Rialto. The Southern Sierras Power Company has joined with the Corona (Cal.) Gas & Electric Company, the Bishop (Cal.) Light & Power Company, the Coachella (Cal.) Valley Ice & Electric Company and the Rialto Company for authority for the Southern Sierras Power Company to purchase the last four corporations.

SAN FRANCISCO, CAL.—An agreement has been reached under which the Pacific Gas & Electric, the Great Western Power and the Sierra & San Francisco companies have consolidated (as a war measure) to operate their electric plants, both steam and hydroelectric, under one head. It was made primarily for the purpose of conserving fuel oil and has the sanction of the State Railroad Commission and will last for the period of the war.

WESTON, UTAH.—Application has been made by the citizens of Weston to the Public Utilities Commission asking for an extension of the service lines of the Utah Power & Light Company to Weston. The town is at present without electrical service. A 5-mile extension of the Utah Company's line would be necessary, the cost of which is estimated at $16,000.

LUSK, WYO.—Contract has been awarded by the town of Lusk to the Fairbanks-Morse Company for a 100-hp. semi-Diesel oil engine and a 60-kva., 60-cycle, three-phase, 2300-volt generator (directly connected), and a 20-hp. motor for water works, to be installed in May. L. S. Berry is consulting engineer.

BEOWAWA, NEV. — The electric plant of the Beowawa Electric Light Company has been purchased by the Nevada Valleys Power Company, which owns and operates the plant at Battle Mountain. The equipment of the local plant will be transferred to Battle Mountain and installed in the plant there.

Canada

GLADSTONE, MAN.—The Town Council is considering the installation of an electric distributing system to supply electricity for commercial, domestic and street lighting purposes.

ALVINSTON, ONT.—The project for a hydroelectric development on the Sydenham River, to cost about $28,000, is being held in abeyance until an effort is made to secure service from hydro system.

HAILEYBURY, ONT. — The Dickson Creek Mining Company is considering the installation of electrically driven drills at its property on Dickson Creek.

HAMILTON, ONT.—E. R. Gray, chief engineer, is preparing a report to be submitted to the Board of Control in connection with the project suggested by T. J. Stewart that the transmission lines of the Toronto & Niagara Power Company be connected up with the Beach pumping station to insure a supply of energy in case of breakdown of the Hydro-Electric service.

OTTAWA, ONT.—Bids will be received by John Pearson and J. O. Marchand, Center Block, Parliament Hill, Ottawa, until April 23, for electric conduit and fittings required in the reconstruction of the Parliament Buildings. Specifications and further information may be obtained at the office of P. Lyall & Sons Construction Company of Ottawa.

TIMMINS, ONT.—A new electric generating unit, consisting of a 3750-kva. Canadian Westinghouse generator with a 4000-hp. Morgan-Smith waterwheel, is being installed in the power plant of the Northern Canada Power Company. E. S. Noble is superintendent.

TORONTO, ONT. — The Hydro-Electric Power Commission has taken over the property of the Essex County Light & Power Company of Leamington, which supplies electrical service in Amherstburg, Kingsville, Essex, Leamington, Harrow, Canard River and Cottam, at $226,000. The system of the Essex company consists of 55 miles of 26,400-volt transmission lines in addition to distributing systems in the municipalities named and was owned and operated by the Detroit Edison Company of Detroit, Mich.

CHAMBLY, QUE.—The local dam of the Montreal Light, Heat & Power Company was recently carried away by floods.

ARCOLA, SASK.—The Arcola Light & Power Company is contemplating changing its system from single-phase, 110 volts, to three-phase, 2300 volts, and establishing a day service for a power circuit. H. Forbes Robert is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 2, for furnishing, under circular 1214, sheet and flat steel, marine telegraphs, transformers, electric switches, testing blocks, marine brackets, carbon brushes, condulets, connectors, cut-outs, marine fixtures, plugs, rosettes, steel and copper wire, etc. Further information may be obtained at the above office.

SAN JUAN, HONDURAS. — The iron pipes furnishing water for operating the electric plant at San Juan have been blown up by dynamite. The plants have a daily generating capacity of 7000 hp.

Record of Electrical Patents

Notes on United States Patents

(Issued March 26, 1918.)

1,260,424. COMMON-BATTERY TWO-WIRE REPEATER SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed July 12, 1909. Improvements.

1,260,441. HEATER FOR INTAKE MANIFOLDS OF INTERNAL-COMBUSTION ENGINES; Bert N. Parrish, Jackson, Mich. App. filed May 28, 1917. Heat generated is efficiently transmitted to the walls of the manifold.

1,260,450. ELECTRICALLY CONTROLLED INDICATOR; Earl S. Rau, Elkins Park, Pa. App. filed Nov. 29, 1916. Improved.

1,260,461. FIRE-ALARM-BELL RINGER; Wilton S. Schuyler, Savannah, Mo. App. filed July 7, 1916. Efficient and serviceable.

1,260,463. ALTERNATING-CURRENT RECTIFIER; Ray F. Seitz, Portsmouth, Ohio. App. filed July 3, 1917. For charging storage batteries.

1,260,472. STORAGE-BATTERY ELECTRODE; Thomas Spencer, Philadelphia, Pa. App. filed Aug. 21, 1915. Means for retaining the active material.

1,260,480. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed July 8, 1916. Improvements.

1,260,481. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed March 8, 1913. Improvements.

1,260,482. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed May 27, 1915. Improvements.

1,260,483. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed May 27, 1915. Improvements.

1,260,556. AUTOMATIC WEIGHING DEVICE; Frank E. Layman, Milwaukee, Wis. App. filed April 8, 1912. Accurate results when small amounts of material are weighed.

1,260,564. ELECTRIC HEATER; Carl E. Magnusson and Leslie F. Curtis, Seattle, Wash. App. filed Sept. 26, 1917. Induction type.

1,260,591. SNAP SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed June 22, 1917. Improvements.

1,260,592. JUNCTION TERMINAL BLOCK; Guy F. Sturgeon, Chicago, Ill. App. filed Feb. 10, 1915. Improvement.

1,260,607. COMBINATION LOCK SWITCH; Samuel S. Ward, Vienna, S. D. App. filed April 21, 1917. Automobiles.

1,260,613. SYSTEM OF CONTROL; Charles C. Whittaker, Wilkinsburg, Pa. App. filed March 4, 1916. For governing the operation of the driving motors of an electric locomotive.

1,260,617. RAILWAY SIGNALING; Henry S. Young, Wilkinsburg, Pa. App. filed Dec. 24, 1915. Improvements.

1,260,630. LIGHTNING ARRESTER; Quincy A. Brackett, Pittsburgh, Pa. App. filed June 16, 1916. Outdoor service.

1,260,647. REGULATOR AND CUT-OUT; Frank Conrad, Swissvale, Pa. App. filed April 2, 1913. Automobiles.

1,260,648. ELECTRICAL SYSTEM; Frank Conrad, Pittsburgh, Pa. App. filed Dec. 31, 1913. Controlling the rate at which storage batteries may be charged to correspond to the degree to which the batteries are charged.

1,260,649. REGULATOR AND CUT-OUT; Frank Conrad, Pittsburgh, Pa. App. filed Aug. 7, 1914. Automobiles.

1,260,661. METHOD OF RECOVERING METALS FROM ALLOYS; Julius H. Gillis, Toronto, Ont., Canada. App. filed Sept. 4, 1917. Electrolytic method.

1,260,665. CONTROLLER; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 4, 1913. Used with switching apparatus of the rotatable drum type.

1,260,669. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Oct. 7, 1915. For effecting power-factor corrections.

1,260,666. CONTROL SYSTEM; Arthur J. Hall, Wilkinsburg, Pa. App. filed Jan. 5, 1915. Dynamo-electric machines.

1,260,670. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 5, 1916. Ventilation of heavy-duty motors of the inclosed type.

1,260,674. COIL WEDGE FOR DYNAMO-ELECTRIC MACHINES; Ray P. Jackson, Edgewood Park, Pa. App. filed Jan. 2, 1915. Used in the coil-containing slots.

1,260,675. REGULATOR FOR ELECTRICAL CHARGING SYSTEMS; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 3, 1913. Improvements.

1,260,708. ELECTRIC SWITCH CONSTRUCTION; Clarence D. Platt, Bridgeport, Conn. App. filed July 21, 1917. Inclosed type.

1,260,712. STREET AND STATION INDICATOR; Fred B. Robison, Fort Winfield Scott, Cal. App. filed Feb. 6, 1917. Improvements.

1,260,721. CONTROL SYSTEM; Francis H. Shepard, New Rochelle, N. Y. App. filed Dec. 26, 1913. Multiple-unit type.

1,260,729. METAL-FILAMENT LAMP; Johann E. C. Struve, Hamburg, Germany. App. filed March 27, 1914. Represents the contour of letters.

1,260,730. CONTACT MEMBER; Emmett W. Stull, Wilkinsburg, Pa. App. filed June 18, 1913. For electrical apparatus.

1,260,742. ELECTRIC INCANDESCENT LAMP; Manfred Aron, Charlottenburg, near Berlin, and Wilhelm Keppel, Berlin, Germany. App. filed Dec. 19, 1913. Improvement.

1,260,743. TRANSFORMER AND METHOD OF MAKING THE SAME; Sulo Attila, Frankfort-on-the-Main, Germany. App. filed July 29, 1909. Adapted for use with metallic-filament lamps.

1,260,747. ELECTRIC-ARC LAMP; Frederick R. Boardman, Richard V. Boardman and Frank Boardman, Upton Park, England. App. filed Dec. 17, 1913. Plurality of pairs of carbons.

1,260,750. LIGHTNING ARRESTER; Stanley C. Bryant, Chicago, Ill. App. filed July 21, 1916. Open or exposed air gaps, with the line protected by the arrester not grounded in case the exposed air gaps are bridged or filled with foreign particles.

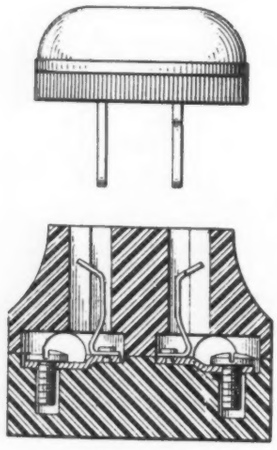
1,260,785. ROTARY RECTIFIER OF ALTERNATING CURRENT; Constantine D. Macropoulos, New York, N. Y. App. filed Jan. 21, 1914. Eliminates sparking.

1,260,809. CIRCUIT BREAKER; Lewis T. Rhoades, Mont Clare, Pa. App. filed Sept. 25, 1917. Employs mechanical and magnetic means to interrupt the current through the induction coil.

1,260,819. APPARATUS FOR WINDING COIL CONDENSERS; Wolfgang E. Schwartzmann, Long Meadow, and Charles M. Wild, Springfield, Mass. App. filed May 16, 1916. Improvements.

1,260,830. ELECTROLYTIC DEPOSITION OF COPPER FROM ACID SOLUTIONS; Franz E. Studt, London, England. App. filed July 18, 1916. Improvements.

1,260,843. END PLATE FOR COMBINED IGNITING AND LIGHTING GENERATORS; James M. Wilson, Newark, N. J. App. filed June 30, 1915. Improvements.



1,261,649—Attachment-Plug Receptacle

1,260,853. ELECTRIC LIGHT FIXTURE; Lincoln C. Bair, Kansas City, Mo. App. filed March 26, 1917. Means for suspending bowls of different sizes from the same device.

1,260,875. ELECTRIC ARC WELDING FOR BRAZING; George W. Cravens, Westfield, N. J. App. filed July 23, 1915. Improvements.

1,260,866. BURGLAR ALARM FOR AUTOMOBILES; Thomas F. Burke, Philadelphia, Pa. App. filed June 5, 1917. Improvements.

1,260,889. SYSTEM FOR MOTOR CONTROL; Lionel Fleischmann, Berlin, Germany. App. filed April 16, 1915. Brake which is automatically applied when the motor circuit is opened.

1,260,913. RAIL BOND; Bruce C. Kixmiller, Bicknell, Ind. App. filed May 21, 1917. Electrically connecting.

1,260,930. ALARM SYSTEM; Carl F. Mead and Louis E. Richmond, Cleveland, Ohio. App. filed March 7, 1914. Fire alarm.

1,260,940. APPARATUS FOR WELDING TUNGSTEN INGOTS; Carl A. Pfanstiehl, Waukegan, Ill. App. filed July 12, 1915. Provides an electric furnace.

1,260,971. AUTOMATIC TELEPHONE SYSTEM; Alfred H. Dyson, Chicago, Ill. App. filed Nov. 13, 1906. Improvements.

1,260,982. VOLTMETERS; Frank A. Laws, Salem, and Chester L. Dawes, Cambridge, Mass. App. filed Feb. 6, 1914. Enables extreme points reached by an alternating voltage wave to be indicated and measured.

1,260,985. IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Carl T. Mason, East Orange, N. J. App. filed Sept. 29, 1916. Sparking voltage is furnished by a high-tension magneto.

1,260,989. ELECTRIC ARC WELDING OR BRAZING; George W. Cravens, Garwood, N. J. App. filed July 23, 1915. Improvements.

1,260,994. ELECTRIC REGULATOR; Joseph Bijur, New York, N. Y. App. filed Dec. 1, 1909. Improvements.

1,260,995. ELECTRIC REGULATOR; Joseph Bijur, New York, N. Y. App. filed July 1, 1910. Extreme variation in a resistance element is efficiently utilized.

(Issued April 2, 1918.)

1,261,024. ELECTRIC FIXTURES; Gustav A. Harter, Chicago, Ill. App. filed March 18, 1916. Semi-indirect fixture.

1,261,048. DISTRIBUTOR FOR IGNITION DEVICES; Charles T. Mason, Sumter, S. C. App. filed Sept. 15, 1916. Improvements.

1,261,069. POWER TRANSMISSION; John G. P. Thomas, Chiswick, London, England. App. filed Oct. 11, 1913. Improvements.

1,261,079. GOVERNING DEVICE FOR MAGNETOS; Robert M. Warren, Sumter, S. C. App. filed Feb. 19, 1917. For gas engines.

1,261,086. MEANS FOR REGULATING TEMPERATURE; John C. Wilson and Horace H. Packard, Milwaukee, Wis. App. filed Aug. 16, 1912. Thermal fluid motors.

1,261,091. SAFETY ELECTRIC-CIRCUIT BREAKER FOR AUTOMOBILES; Charles Alcon, Indianapolis, Ind. App. filed Dec. 5, 1916. Means for protecting automobiles and motor-driven vehicles.

1,261,096. TESTING APPARATUS; Otto B. Blackwell, Maplewood, N. J. App. filed Oct. 2, 1916. For determining the transmission losses occurring in electrical transmitting paths.

1,261,102. CENTRIFUGAL SWITCH; Joel R Cook, Wilkinsburg, Pa. App. filed Feb. 17, 1913. For single-phase induction motors.

1,261,126. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 1, 1915. Magnetizable core members for dynamo-electric machines.

1,261,140. ELECTRICAL BOND FOR RAILWAY RAILS; John C. Lincoln, Cleveland, Ohio. App. filed Feb. 25, 1916. Readily attachable.

1,261,169. CONTROL APPARATUS; Karl A. Simmon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 6, 1914. For dynamo-electric machines and liquid rheostats.

1,261,178. METHOD AND MECHANISM FOR REDUCING RESISTANCE OF AIR GAPS; William W. Strong, Mechanicsburg, Pa. App. filed Jan. 14, 1913. Method of deriving a unidirectional current.

1,261,193. TERMINAL FOR DYNAMOS; Harry R. Van Deventer, Sumter, S. C. App. filed June 10, 1916. Ignition dynamos.

1,261,239. GENERATING SYSTEM AND GENERATOR THEREFOR; Edward B. Jacobson, Pittsfield, Mass. App. filed Nov. 9, 1914. Battery charging.

1,261,250. STREET OR STATION INDICATOR; John O. Lough, Montreal, Quebec, Canada. App. filed March 9, 1917. Improvements.

1,261,251. ELECTRICALLY OPERATED CROSSING SIGNAL; Chester L. Lynch, Seattle, Wash. App. filed Sept. 19, 1916. Improvements.

1,261,256. THERMAL ELECTRIC CUT-OUT; Roy H. Maple, Indianapolis, Ind. App. filed Nov. 20, 1914. For use on low-voltage circuits.

1,261,266. PERMUTATION LOCK FOR AUTOMOBILES; William H. Mitchell, St. Louis, Mo. App. filed Feb. 26, 1917. One permutation-indicating device controls the valve and the switch simultaneously.

1,261,269. BATTERY; William Morrison, Chicago, Ill. App. filed Nov. 2, 1917. Storage battery.

1,261,272. APPARATUS FOR SYNCHRONIZING MUSIC AND MOTION PICTURES; Edward W. Myers, Los Gatos, Cal. App. filed Aug. 21, 1916. Improvement.

1,261,290. TELEGRAPH SYSTEM; Paul M. Rainey, Glen Ridge, N. J. App. filed May 15, 1915. Multiplex telegraphy.

1,261,345. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Joseph Bijur, New York, N. Y. App. filed March 9, 1915. Improved.

1,261,347. ELECTRIC LIGHTING SYSTEM; William L. Bliss, Niagara Falls, N. Y. App. filed Aug. 24, 1912. For use with steam or electrically driven system.

1,261,376. MAGNETIC CONTROLLING DEVICE FOR RAILWAYS; Austen H. Fox and Arnold W. Lenderoth, Stapleton, N. Y. App. filed Nov. 8, 1915. Improvements.

1,261,386. DYNAMO-ELECTRIC MACHINE; Rudolf Hellmund and Charles W. Starker, Pittsburgh, Pa. App. filed Dec. 4, 1914. Internal ventilation during operating condition.

1,261,391. TELEPHONE DIAPHRAGM; Fred Hoyt, Seattle, Wash. App. filed Oct. 25, 1916. Improved means for mounting a vibrating diaphragm in a sound transmitter.

1,261,395. ELECTRODE AS USED FOR WELDING PURPOSES; Malcolm M. Irvine, Glasgow, Scotland. App. filed Sept. 17, 1917. Improvements.

1,261,456. SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed June 22, 1917. Improvements.

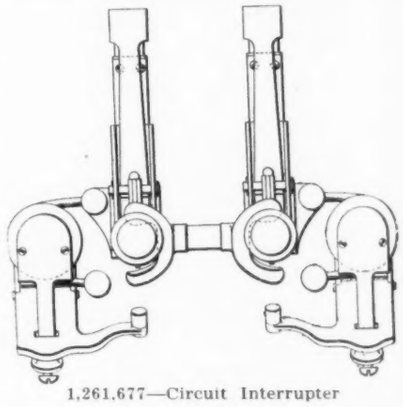
1,261,470. INDUCTION WATER HEATER; Charles A. Backstrohm, Crafton, Pa. App. filed Sept. 12, 1916. Loss in the return magnetic circuit is utilized for heating the water.

1,261,477. ELECTRIC LIGHTING FIXTURE; George A. Boomer, Waterbury, Conn. App. filed Nov. 22, 1917. Improvement.

1,261,490. APPARATUS FOR RECORDING AND COMPILING STATISTICAL DATA; Wyland B. Clark and Frederick J. Pritchard, Washington, D. C. App. filed June 12, 1916. Improvements.

1,261,492. TELEPHONE SYSTEM; Hiram D. Currier, Richard I. Utter and Michael B. Stazak, Chicago, Ill. App. filed July 27, 1914. Trunking system.

1,261,510. RAILWAY-TRAFFIC-CONTROL APPARATUS; Robert M. Glison, Pittsburgh, Pa. App. filed Aug. 11, 1916. Improvements.



1,261,677—Circuit Interrupter

1,261,578. ELECTRICAL CONTACT SHOE; William W. MacFarlane, Philadelphia, Pa. App. filed April 20, 1916. Improvements.

1,261,593. STARTER MECHANISM; William Morrison, Chicago, Ill. App. filed Feb. 14, 1916. Double rotor dynamo-electric clutch.

1,261,636. FUSE; Ray Smith, Dayton, Ohio. App. filed March 2, 1917. Fuse elements may be readily replaced.

1,261,644. ELECTRIC MOTOR CONTROL; Walter C. Strang, Yonkers, N. Y. App. filed April 4, 1913. Improved means for slowing down and stopping electric motor.

1,261,649. ATTACHMENT-PLUG RECEPTACLE; George B. Thomas, Bridgeport, Conn. App. filed July 5, 1917. Proper engagement between the jack blades and the receptacle terminals is insured.

1,261,673. ROTOR FOR DYNAMO-ELECTRIC MACHINES; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed July 28, 1916. High speed.

1,261,677. CIRCUIT INTERRUPTER; Winfield A. Atwood, Schenectady, N. Y. App. filed June 14, 1915. Movable members interconnected by an interlocking device.

1,261,698. BRAKE-OPERATED STOP-SIGNAL SWITCH FOR AUTOMOBILES; Emil Carlson, Pasadena, Cal. App. filed March 8, 1917. Signal apparatus mounted beneath the floor of a motor vehicle.

1,261,708. ELECTRON-DISCHARGE DEVICE; William D. Collidge, New York, N. Y. App. filed June 13, 1916. Improvements.

1,261,711. PROTECTIVE DEVICE; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 2, 1912. For electric circuits.

1,261,744. ELECTRICAL SWITCHING DEVICE; Arthur O. Dady, New York, N. Y. App. filed April 12, 1916. For ignition circuits of internal-combustion engines.

1,261,745. FIRE-ALARM APPARATUS; Vernon Durbin, Brookline, Mass. App. filed July 25, 1916. Improvements.